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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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74 OPTICS 1515
Includes light phenomena.

75 PLASMA PHYSICS 1515
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 1516
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1518
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1518
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1519
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 1521
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1522
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1522
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 1527

89 ASTRONOMY 1530
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1531
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1532
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1532
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1533
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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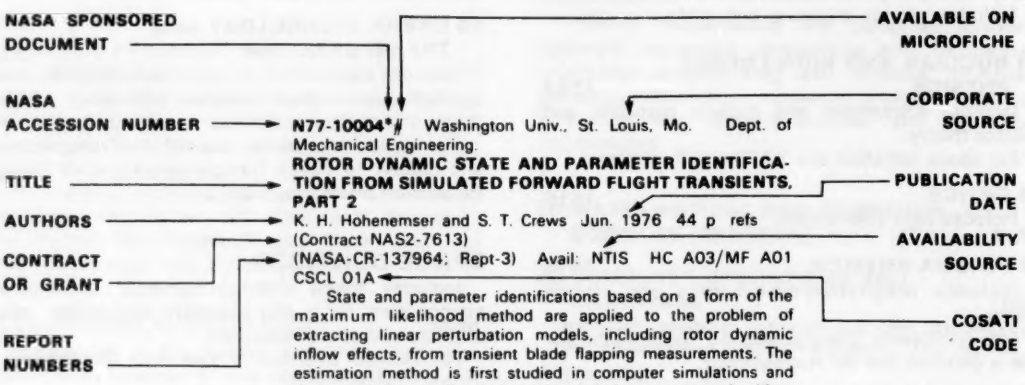
TYPICAL CITATION AND ABSTRACT



N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.

ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2

K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs

(Contract NAS2-7613)

(NASA-CR-137964; Rept-3) Avail: NTIS HC A03/MF A01 CSCL 01A

State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, NAVY VEHICLE DESIGN AND CONSTRUCTION - HANDBOOK FOR DESIGN CRITERIA FOR IMAGING SENSOR DISPLAYS
W.L. CAREL, Hughes Aircraft Company, *Culver City, California* 90230 (DN223505; N00014-76-C-0558)

The proliferation of display requirements for modern fighter and attack aircraft has forced the integration of information into multiple- function displays. The establishment of associated display design criteria for various sensor information is a necessary step to the specification of multifunction, multiformat displays for Navy aircraft.

The task will define display design criteria for airborne sensor information for use with multifunction displays. The criteria will be developed from previous analytical investigations and research experiments. These experiments addressed optimally matching display parameters to their corresponding sensor parameters, relative to operator performance and assuming a day/night radar and EO display in a jet attack type aircraft. These data will be brought together and developed into a handbook of design criteria.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0002, LOW-COST GRAPHITE/THERMOPLASTIC SECONDARY STRUCTURE
W.F. WENNHOLD, General Dynamics Corporation, *San Diego, California* 92112 (DN581073; N62269-74-C-0369)

To demonstrate and evaluate the cost savings attainable through design to low manufacturing cost by application of graphite reinforced thermoplastic composites to a representative aircraft secondary structural component. This work is in support of work unit ZA101, Aircraft Technology, agency accession no. DN 681080.

The main landing gear door of the Convair model 200 fighter was selected as the secondary aircraft structure demonstration component. The structure will be redesigned and tested and the results compared with the metal prototype design using cost and weight as the primary evaluation criteria.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle T, Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0003, DEVELOPMENT OF LABORATORY VERSION OF ADVANCED GCA CONTROLLER TRAINING SYSTEMS
L. EGAN, Logicon Incorporated, *San Diego, California* 92110 (DN494015; N61339-74-C-0048)

To develop techniques for improving quality control while reducing costs in the training of personnel to perform a class of control activity such as ground control approach, ground controlled intercept and certain functions of the radar intercept officer. These jobs have in common the need to use restricted, stylized speech to guide a recipient man-machine system to a well-defined goal. This task will examine the potential for more effectively meeting controller training requirements of combining advanced technologies including, but not limited to, the following: (a) machine understanding of spoken commands, (b) automated adaptive training, (c) advanced computer programming, (d) advanced training requirements analysis.

Develop enough of a system to demonstrate the feasibility of the concept in the case of a single GCA controller guiding a single aircraft. An earlier study produced an analysis of requirements and a functional design for a training system directed to the PAR phase of the GCA. The current effort is to implement and debug the design to provide a laboratory version of the training system.

ADDENDA: Supporting agency address is: Naval Training Equipment Center Human Factors Lab, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0004, AIRCRAFT FUEL TANK SIMULATOR,
L. MAHOOD, Falcon Research & Dev. Company, *Denver, Colorado* 80218 (DF457760; F33615-76-C-2042)

Design, development, construction and checkout of an aircraft fuel tank simulator that permits realistic measurements of ullage composition and system response to combat induced threats.

Based on Air Force guidelines, contractor shall develop a design of a fuel system simulator that operates over the typical aircraft environment. Approved design will be constructed and installed at WPAFB OH. Checkout will be accomplished and operational capability demonstrated.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory SFH, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0005, HELICOPTER BEARING DEVELOPMENT TEST PROGRAM
C. KELLER, United Aircraft Corporation, *Stratford, Connecticut* 06497 (DN581546; N62269-75-C-0107)

Provide bearing performance data on sample bearings tested in accordance with MIL-B-81819. This contract supports work unit DK603, agency accession no. DN 833210.

Perform dynamic tests on sample bearings and record data as required.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehical Technology Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0006, ADVANCED AIR TRAFFIC CONTROL
F.D. QUEEN, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680218)

The near-term objective of the program is to establish a technology base in ATC to solve the problems of curved approach, flare, decrab, rollout, and taxi at tactical air fields under conditions of zero-zero visibility. The long-term objective is to provide a technology base for all-weather automated landings.

The technical approach to the near-term problem will include the assessment of accuracy of aircraft attitude sensors, determination of measurement accuracies required in attitude and position, and development of sensors to meet the imposed accuracy requirements. Techniques using a variety of observables will be tested on a laboratory range or on an aircraft as appropriate. Development of the refined system for tactical aircraft will proceed using contractors.

ADDENDA: Supporting agency address is: Naval Electronic Systems Command Research and Technology Direct. (3301) Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0007, SUBSCALE FLUTTER TESTING OF TF-41-A-100 LP1 BLADES

E. STEVENS, General Motors Corporation, *Indianapolis, Indiana* 46206 (DF457010; F33615-74-C-2043)

To establish the geometric scalability of turbine engine fan and compressor flutter phenomenon. Verification of the flutter phenomenon will provide potential for increased versatility, reduced time and cost for future component and engine development programs involving flutter. The specific objectives are (a) fabrication of a geometrically scaled version of the original clapperless TF-41-A-100 first-stage fan blade, (b) conduct bench tests to determine critical frequencies and fatigue of the blades, (c) provide adequate instrumentation to record sensitivity of the blades to critical frequencies and stress levels, and (d) conduct scale-model rig tests to determine scalability of the flutter phenomenon observed on the full-scale TF-41-A-100 first-stage fan blades.

There are four phases: 1. Rig hardware application, adapt hardware to conduct tests on an eight-inch-diameter scaled fan, 2. Bench testing of at least two blades to establish rig monitor stress limits. A comparison will be made with full-scale testing to determine accuracy, 3. Rig testing to duplicate previous flutter testing of full-scale first-stage plan, and 4. Correlation studies using the results of the testing and varying parameters to establish the geometric scalability of flutter phenomenon.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0008, NAVY VEHICLE DESIGN AND CONSTRUCTION - FLUTTER OF AXIAL-TURBOMACHINE BLADING

F.A. SISTO, Stevens Institute of Technol., School of Engineering, *Hoboken, New Jersey* 07030 (DN923286; N00014-76-C-0540)

Theoretical analysis, supplemented by experimental measurements, is being carried out on the self-excited and forced vibration aspects of typical gas turbine compressor blading stages. Such vibration, leading to gross mechanical behavior effects known as 'blade flutter', is a difficulty which has led to failure in meeting full design requirements for aircraft jet engines. This research contributes to assuring optimum jet engine performance at maximum rated power, and hopefully to increased life and reliability of military engines.

The investigation aims at acquisition of accurate experimental blade flutter data from annular cascade rigs incorporating suitable test sections, blowing equipment and variable guide vanes and blading. The many geometric, aerodynamic, vibratory parameters affecting nonstationary aerodynamic lift and moment coefficients are considered. A computer program is being perfected for mapping stall flutter boundaries and a rotor rig is being designed with greater accuracy (vs. a stator rig) in procuring aeroelastic data.

ADDENDA: Supporting agency address is: Office of Naval Research 473, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0009, DEVELOPMENT OF REQUIREMENTS FOR GROUND STARTING EQUIPMENT FOR PROPULSION SYSTEMS

D.D. CROCE, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696014)

Investigate propulsion systems air start requirements and determine the portable/fixed start systems to support these requirements.

Conduct exploratory studies to determine the projected engine start requirements over the next 25 years. Conduct fleet surveys to analyze capabilities of current equipment to meet updated requirements.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0010, STATE-OF-THE-ART REVIEW

E. LISTER, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN596801)

To continually develop for, and make available to the Navy, the latest state-of-the-art information regarding air-breathing propulsion and associated areas.

Continually update a data bank of engine and engine component characteristics and performance. Periodically prepare state-of-the-art reports (SOAR) on major engine components and subsystems (United States and foreign). This type of information is a basic ingredient for the development of advanced planning requirements and program selection.

ADDENDA: Supporting agency address is: Naval Air Systems Command Propulsion Technology Administrator, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0011, MASTER MONITOR DISPLAY FOR FUTURE NAVAL AIRCRAFT

B. AMOS, Grumman Corporation, *Bethpage, New York* 11714 (DN781225; N62269-76-C-0199)

To determine the optimum design characteristics for a master monitor display for the 1980 era aircraft. The MMD is intended to provide the pilot with warning, caution, mode advisory, function failure, and auxiliary information on a single display surface. This contract supports work unit ZA101, agency accession no. DN681080.

The contractor will provide the necessary supplies and services to conduct an application study of the MMD system to the F-14 aircraft.

ADDENDA: Supporting agency address is: NADC Air Vehicle Technology Dept., Warminster, PA.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0012, DESIGN AND FABRICATION OF A COMPOSITE F-14 MAIN LANDING GEAR STRUT DOOR

G. LUBIN, Grumman Corporation, *Bethpage, New York* 11714 (DN581069; N62269-74-C-0535)

To design and fabricate structurally reliable and cost effective F- 14 main landing gear strut doors, using fiberglass/graphite/epoxy material, that will be practical and suitable for full-scale production. This work is in support of work unit ZA101, Aircraft Technology, agency accession no. DN681080.

Perform design and analysis to produce a door design that will be of lower cost and weight than the existing aluminum door, at no sacrifice in performance. As a baseline for this design, the contractor will use a previously designed composite door that was structurally sound, and lower in weight, but not cost-effective. The final design will reflect all the experience gained in the fabrication and test of the first door. Perform tooling and manufacturing concept studies for production optimization. Manufacture three doors using production bonding tools and standard composite production techniques. (One door will be laboratory static tested at the NavAirDevCen to qualify the design for flight.) Install one door on a Navy aircraft and flight test for operational suitability and functionality. (Cost of the flight test is not included in the cost of the contract.)

ADDENDA: Supporting agency address is: Naval Air Development CE, Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0013, NI76XB TURBINE BLADES
E. KERCIZNIK, General Electric Company, *Cincinnati, Ohio* 45215 (DN696803; N00140-75-C-0355)

To operate advanced D.S. superalloy high-pressure turbine blades in an advanced military engine at bulk metal temperatures 60 degrees F higher than is currently possible with the best conventional D.S. superalloys such as MAR-M-247 (HF) and MAR-M-200 (HF) and to achieve a 300 hour level of blade durability at this temperature.

The program is organized as follows: Phase I - MFG trial blades in order to define casting parameters for blade manufacture - 6 months. Phase II - make engine-quality blades. Cast two blade sets plus spares but machine only one set for subsequent engine tests - 11 months. Phase III - engine assembly and test - 9 months.

ADDENDA: Supporting agency address is: Naval Air Propulsion Test Center Research and Technology Group (PE4), Trenton, NJ 08628

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0014, EXPERIMENTAL FLIGHT-TEST EVALUATION OF J79 B/AL BLADES
R.J. STABRYLLA, General Electric Company, *Cincinnati, Ohio* 45215 (DF459270; F33657-76-C-0608)

The objective of this effort is to develop and structurally qualify boron/aluminum J-79 first-stage blades for engine qualification testing and evaluate their durability response during subsequent experimental flight-test exposure in an RF4/J79-15 turbine engine.

The approach consists of seven tasks. The first two tasks are to develop B/Al blades having improved bond quality and reproducibility suitable for structural, engine qualification and flight testing. The succeeding three tasks include design analysis and bench and structural FOD tests requisite for proceeding to engine qualification testing. The sixth task consists of the procurement of flight-test replacement blades. The seventh task includes component build-up, engine installation, delivery to WPAFB for endurance testing and evaluation of flight-test evaluation blades.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0015, PRELIMINARY DESIGN OF A COMPOSITE WING FOR NAVY-V/STOL PROTOTYPE
O.G. ACKER, Rockwell International Corp., *Columbus, Ohio* 43216 (DN581067; N62269-74-C-0577)

To advance fibrous composite aerospace structures technology by the preliminary design of a major structural component representative of new fighter aircraft and to provide the basis for advanced development efforts to demonstrate the practicality of such structures. To support the Navy V/STOL prototype program by focusing on the preliminary design of a lightweight, highly reliable wing assembly with sufficient similarity to the final systems configurations to minimize transition from development to production status. To provide the technical basis, the economic analysis, and (by demonstration) the confidence needed for large-scale commitment of composites to future Navy aircraft structures. This work is in support of work unit ZA101, Aircraft Technology, agency accession no. 681080.

Conduct the preliminary design of a full-scale composite wing structure forward of the augmenter for the SFV-12A V/STOL fighter attack prototype. Fabricate one structural test specimen representing this structure between wing stations 0 and 79. 5.

ADDENDA: Supporting agency address is: Naval Air Development Center A, Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0016, FLIGHT TEST OF LIGHTWEIGHT HYDRAULIC SYSTEM IN T-2C AIRCRAFT
J.N. DEMARCHI, Rockwell International Corp., *Columbus, Ohio* 43216 (DN781220; N62269-76-R-0254)

Conduct flight evaluation of lightweight hydraulic system (LHS) (8000 psi) in T-2C aircraft to assess conformance with design and performance requirements. This is preliminary to advance development program and design of LHS systems for future Navy lightweight supersonic V/STOL aircraft. This supports work unit ZA101, agency accession no. DN681080.

Aircraft BUNO 152382 will be modified to accept the laboratory- tested aileron (8000 psi) system. Preliminary ground checks shall be performed prior to the scheduled flights. The system's operation will be monitored under the various flight attitudes, speeds and altitudes. Inflight data and pilot's comments will be evaluated after each flight.

ADDENDA: Supporting agency address is: NADC Air Vehicle Technology Dept., Warminster, PA.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0017, DEVELOPMENT OF LIGHTWEIGHT HYDRAULIC SYSTEM FOR ADVANCED VFX(V/STOL) AND VAX AIRCRAFT
J. DEVER, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN833208)

To develop an advanced hydraulic system/components for advanced VFX(V/STOL) and VAX Naval aircraft to reduce space requirements by 40 plus and system weight by 30 plus. This system will greatly alleviate space weight deficiencies and allow conformance to the stringent requirements of advanced high-density thin-wing airframes. Application of high-pressure principles will be utilized to realize these savings.

Conduct development of a LHS (lightweight hydraulic system) (8000 psi) hydraulic-actuator system and pump to establish dynamic system responses and pump performance at various operating parameters. Formulate a design specification for a solenoid valve and test under various high-pressure system conditions. Develop experimental high- pressure systems and perform endurance evaluations to analyze performance and design of critical components. Evaluate less flammable fluid (MIL-H-83282) high-pressure leakage characteristics and seal designs. A major effort will be directed toward the application of the developmental concept to advanced design aircraft as the V/STOL. Work is also being performed on contract as reported in work units DK601B, DK601B1, and DK601B2.

ADDENDA: Supporting agency address is: Naval Air Systems Command Equipment/Support Administrator (340C/530312), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0018, HELICOPTER RECOVERY SYSTEMS FOR ASW STORES
J.H. CAMISA, U.S. Navy, Underwater Systems Center, *Newport, Rhode Island* 02840 (DN589517)

The overall objective is to develop and evaluate helicopter recovery ASW stores systems and equipment for potential use in land- based and open-ocean recovery operations. Of particular importance at this time are: a. Development of an experimental shock mitigation device to improve helicopter rescue hoist/recovery equipment compatability. B. Development of an experimental modified MK 44/ADDS recovery cage to improve recovery efficiency, flight characteristics and at-sea based capabilities. C. Development of an experimental stowable recovery system for a wide range of ASW stores.

A. Investigate the helicopter rescue hoist/recovery equipment interface for acceleration and loading characteristics. Develop and evaluate experimental chock mitigating devices to decrease shock loadings experienced during hoist operation. B. Develop an experimental MK 44/ADDS recovery cage with a larger skirt and barrel to improve flight characteristics, recovery efficiency and open ocean capability. Flight test the experimental cage to demonstrate recovery and establish flight envelopes. C. Develop an experimental recovery system of fixed (non-stowable) skirt design. Evaluate recovery techniques and cage configurations for various modes of recovery. Incorporate stowing concepts into skirt. Flight test the completed experimental model for flight envelopes, stowage deployment and recovery.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0019, AIRCRAFT ENGINEERING DESIGN AND CATALOG DEVELOPMENT
R. ST. JOHN, Ling Temco Vought Incorporated, *Dallas, Texas* (DF138230; F33615-76-C-3117)

The design branch is engaged in conceptual design studies of advanced weapon systems. In order to increase our in-house analysis capabilities, detailed data and weights prediction, methodology improvements are required in the aircraft systems area. However, due to the workload associated with the study efforts, personnel are not available to accomplish these tasks. The objective of this effort is to develop a data catalog of aircraft geometry and system characteristics and to develop an improved systems weights predicted capability. This effort will significantly improve our capability to do systems trade-off studies relative to specific mission requirements.

Detailed geometry and mission related system characteristics will be used in conjunction with statistical multiple regression analysis theory to obtain equations which describe the weight and geometric characteristics of the various aircraft systems.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXBM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, WATER VAPOR PROPERTIES
D.N. ROGOVIN, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (DF185210; F29601-75-C-0132)

The objective of this effort is to provide a theoretical model of the interaction of laser radiation with selected atmospheric molecules (H(2)0, HDO, (3) and CH(4)) at wavelengths of interest for current and future Air Force laser systems (10.6, 5.0, 3.8, 2.7, and 1.3 microns) with particular emphasis on water vapor and its isotopic variants. In particular, the procurement will predict the detailed absorption spectra of these molecules near the above-mentioned wavelengths and, in addition, will predict energy transfer rates associated with thermalization of the absorbed energy.

The theoretical approach to this problem will include: (1) a quantum mechanical multimode analysis of the water molecule, (2) an extension of this analysis to various isotopic species of water such as HDO, (3) a further extension of this analysis or a new model that will treat the quantum structure of ozone and methane, and (4) an analysis of collision processes between the above molecules and other atmospheric constituents N(2), O(2), and CO(2).

ADDENDA: Supporting agency address is: AF Weapons Laboratory ALO Kirtland AFB, NM 87117

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0002, DEVELOPMENT OF HIGH-TOUGHNESS TITANIUM ALLOYS FOR AIRCRAFT STRUCTURES
R.G. BERRYMAN, Rockwell International Corp., *Los Angeles, California* 90009 (DN590157; N00019-76-C-0427)

To develop two titanium alloy specifications with a minimum 135 ksi tensile strength with 100 ksi sq. root of in. fracture toughness and 170 ksi t.s. with 80 ksi sq. root of in. Fit Goal A and Goal B for naval aircraft structural applications.

Evaluate forging characteristics of alloy no. 16, Goal B properties, and further evaluate the properties of alloy no. 5 (MEDA 5) aimed at Goal A properties. Upscaling will be continued.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0003, THEORETICAL INVESTIGATION OF ANOMALOUS PROPERTIES OF BCC, TI, ZR, AND HF ALLOYS 13148-MS
D. DEFONTAINE, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DA0P5576; DAHC04-76-G-0018)

To elucidate the diffusional anomaly in body-centered cubic titanium, zirconium, hafnium metals and alloys and its relations to the beta yields omega phase transformation, which is unique to these metals. The proposal is directly relevant to two programs at AMMRC, one of which is an investigation of the omega phase in titanium and the other of the simulation of lattice defects in solids by computer simulation. Titanium and its alloys are currently being used for mortar base plates, aircraft, and personnel armor. The omega phase, when present, embrittles these alloys so severely as to limit their use. Furthermore, the proposal is potentially relevant to programs at FA on heavy metal (spent uranium) AP projectiles.

The program will include, but will not be limited to the following: (1) formulation of a theoretical model to calculate the coefficient and the activation energy for diffusion based on the partition function of an anharmonic oscillator, (2) calculation of the pressure dependence of the diffusion; (3) calculation and predicition of interdiffusion coefficients in dilute solutions of these alloys.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0004, MATERIAL SUPPORT TECHNOLOGY - SOLID-PHASE EPITAXIAL GROWTH
C.L. ANDERSON, Hughes Aircraft Company, *Malibu, California* 90265 (DN575347; N00014-75-C-0957)

Advancing electron device technologies demand new materials and fabrication techniques which promise easier, quicker, cheaper, and more reliable results for use in Navy systems. A process of thin-film material growth, solid-phase epitaxy, needs to be further developed and evaluated as a new tool in electronics processing.

A systematic study of the solid-phase epitaxy process will be pursued. A variety of metals will be deposited on single-crystal silicon surfaces which have been previously treated in several ways, i.e., sputter etching, chemical etching, etc. Intermetallic layers will be formed by annealing at ultra-high vacuum or in various contaminant environments. The phsyical and electrical characteristics of the layers and junctions thus formed will be analyzed using techniques, such as Auger spectroscopy, Rutherford backscattering, LEED, gamma-ray, Hall measurements, c-v, i-v measurements, and others. Additional studies will be made on structures formed after an amorphous silicon layer is deposited over the metal prior to the annealing. Different forms of amorphous silicon will be studied. Polysilicon will also be considered.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0005, MATERIAL SUPPORT TECHNOLOGY - STUDY OF THE FUNDAMENTAL LIMITATIONS ON MAGNETIC DOMAIN WALL VELOCITIES
R.L. WHITE, Stanford University, Stanford Electronics Labs., *Palo Alto, California* 94305 (DN575051; N00014-75-C-0290)

An understanding of the high domain wall velocities and mobilities in the orthoferrites can lead to improved bubble materials for magnetic memory in naval communication and data processing systems.

Domain wall velocities and the temperature dependence of the domain mobility and velocity will be investigated in orthoferrites. A theory of the normal modes and saturation velocity of domain walls will be developed for canted anti-ferromagnets.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0006, FATIGUE DAMAGE INDICATIONS IN HIGH-STRENGTH AIRCRAFT ALLOYS
S.J. TAO, New England Institute Inc., *Ridgefield, Connecticut* 06877 (DN490034; N00019-75-C-0236)

To determine the levels of dislocation and vacancy density in the surface zones of deformed high-strength aircraft alloys.

Positron annihilation lifetimes to correlate with dislocation and vacancy density levels after deformation of high-strength titanium aluminum and steel alloys. Work will be extended to analyze effect of grain size and voids on position behavior.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0007, FATIGUE DAMAGE INDICATIONS IN HIGH-STRENGTH AIRCRAFT ALLOYS
S.J. TAO, New England Institute Inc., *Ridgefield, Connecticut* 06877 (DN590148; N00019-76-C-0447)

To determine the levels of dislocation and vacancy density in the surface zones of deformed high-strength aircraft alloys.

Positron annihilation lifetimes to correlate with dislocation and vacancy density levels after deformation of high-strength titanium, aluminum and steel alloys. Work will be extended to analyse effect of grain size and voids on positron behavior.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0008, NAVY ENVIRONMENT - ENVIRONMENTAL EFFECTS IN STRESS CORROSION CRACKING IN ALUMINUM ALLOYS
R.T. FOLEY, Amer. University, School of Arts & Sciences, *Washington, District of Columbia* 20016 (DN475438; N00014-75-C-0799)

The objective of this task is to clarify the role of environmental factors in stress corrosion cracking of aluminum alloys used in naval aircraft and craft.

An experimental program is to be conducted to study the effect of various anions in pitting initiation in aluminum alloys, a study of local solution chemistry in these alloys, and a testing phase to correlate the first two approaches with susceptibility of the alloys to stress corrosion cracking. Standard electrochemical and fracture mechanics techniques are to be used for this study.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0009, OPTICAL AND MECHANICAL PROPERTIES OF GLASSES FOR DOMES
P.B. MACEDO, Catholic University of America, School of Engin. & Arch., *Washington, District of Columbia* 20017 (DN575000; N00014-76-C-0201)

Components fabricated of glass are of use in demanding applications including ir domes, radomes, and fiber optic waveguides. Their chief asset is transparency in the infrared, visible and microwave regions. However, they fracture at low levels of mechanical or thermal loading, and show complex and appreciable absorptions. This work concentrates on tailoring of (1) absorption coefficients for chalcogenide-based glasses to control optical and thermal shock behavior, and (2) compressive stress profiles to strengthen silicate glasses.

Work on control of thermal shock hardening of As2S3 based glasses continues. Absorption control via GeS2 additions is being attempted. Impurity bands intensity control by varying hydrogen content is being tried as a means of introducing selective wavelength absorption capabilities. For silicate-based glasses, thermal shock resistance, mechanical strength and refractive index are being varied by 'molecular stuffing'. Thermomechanical properties of doped rods are being measured.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0010, NAVAL VEHICLE TECHNOLOGY - RESEARCH ON COMPOSITES AND NON-METALLIC MATERIALS FOR NAVAL VEHICLES
P. MAST, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN820013)

Investigate the failure characteristics of non-metallic viscoelastic materials such as fiber-reinforced composites, in order to provide criteria for reliable and efficient design in structural applications such as aircraft structures and canopies, rocket cases, torpedoes, ships and deep submergence vehicles. Extend the application of fracture mechanics to these materials to provide the same much-needed benefits that it has provided to linear elastic isotropic materials, i.e., fuller use of the materials properties in military structures.

Develop a theoretical and experimental basis for the extension of fracture mechanics to fiber-reinforced composites and to plastics. Establish failure criteria to describe the modes of failure of these materials. Develop and evaluate automated design techniques for these materials, using computer-based structural analysis programs and previously determined failure criteria.

ADDENDA: Supporting agency address is: Naval Research Laboratory (8000), Washington, DC 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0011, MICROSTRUCTURE-FRACTURE CHARACTERISTICS OF HIGH-STRENGTH NAVAL METALS (ABBREV)
E.A. METZBOWER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620107)

Microscopic cracking mechanisms which cause slow crack growth in advanced military aircraft and ship components are identified by discussions with failure analysts close to the fleet, and studied in the laboratory in efforts to better understand and prevent these failures. Such studies contribute to a better understanding of the basic mechanisms of cracking, selection of better materials, and the designing of standard preventive tests.

The interdependent nature of the stress, microstructure, and environment on the microscopic scale, and how these change with time and crack growth are studied by observing the crack tip and fracture surfaces at high magnifications in electron microscopes, after the cracks have been grown under controlled laboratory conditions.

ADDENDA: Supporting agency address is: Naval Research Laboratory (6000), Washington, DC 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0012, MATERIAL SUPPORT TECHNOLOGY - MAGNETOMETERS, CRYOGENIC DETECTION DEVICES, SUPERCONDUCTIVITY MATERIALS
R.C. SAPP, Univ. of Kansas, School of Liberal Arts & Sci., *Lawrence, Kansas* 66045 (DN523103; N00014-75-C-0834)

This work involves the investigation of the low-temperature properties of magnetic materials used by the Navy as components in electronic equipment magnetometers and superconducting devices in its material support technology and surveillance operations.

Paramagnetic resonance and nuclear orientation techniques are used to determine the interaction and behavior of magnetic crystals with their surroundings. This interaction is obtained by measuring the forces among the magnetic spins (spin-spin interaction) and the forces between the magnetic spins and the host lattice (spin-lattice interaction).

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0013, ELECTROOPTICAL COMPONENT MATERIALS
N. KLAUSUTIS, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900690)

AF function - tactical warfare, detection. Deficiency - lack of adequate electromagnetic materials for use as passive window materials and for anti-reflective and protective coatings for these windows. Objective - to improve the mechanical strength of

prospective laser window materials via the pressure-induced recrystallization (PIR) method. Another segment of the work is concerned with the application of vapor-phase crystal growth techniques to the growth of new/improved laser window materials. How research contributes - the results obtained will contribute to the identification and preparation of improved window materials.

It is planned to subject single crystals of various alkali halides and their alloys to the PIR process and to conduct mechanical, optical and micro-structural examination of these pressed materials. Results obtained will assist in determining the proper processing parameters (temperature, pressure and strain rate) in order to optimize the strength, optical quality and micro-structural stability of the pressed material. Study of the vapor-phase crystal growth technique will continue with emphasis being given to methods for optimizing the growth parameters. The work dealing with the growth of zinc selenide will be completed.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0014, NAVY VEHICLE DESIGN AND CONSTRUCTION - HIGH GRADIENT MAGNETIC SEPARATION OF WEAR PARTICLES FROM FLOWING LIQUID LUBRICANTS

J. OBERTEUFFER, Magnetics Engin. Assoc. Inc., *Cambridge, Massachusetts* 02141 (DN675018; N00014-75-C-1166)

The objective is assess the feasibility of using high gradient magnetic separation techniques to remove micron- and submicron-sized wear debris particles from lubricating oil of Navy aircraft, ship, and submarine lubrication and hydraulic systems. Use of this capability will increase the reliability of these machinery systems.

The approach is to use the operating envelope data obtained in work funded under ONR contract N00014-75-C-0315 to develop and then test the ability of backflushing-batch and continous gradient magnetic filters to remove wear particulates from used gas turbine engine and hydraulic oils.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0015, APPLICATION OF ACOUSTIC EMISSION TO FAILURE MODES IN METALS AND METAL COMPOSITES

A.F. GRENIS, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4746)

The technical objectives are to utilize acoustic emission techniques for the evaluation of metals and also of metal matrix composites suitable for use in aircraft housings, and to perform analytical studies pertaining to composite failure mode characteristics. Recently, ultrasonic sounds emitted by materials under stress have been used in other laboratories to study microcracking in metals and composites. The rate and total count of emitted ultrasonic pulses offers a means for evaluating new materials. The program thrust is survivability (aircraft and combat vehicles, ammunition).

Analytical studies of fiber fracture characteristics in fiber reinforced composites will be continued. Also, the failure mechanism of metals and of composites (such as aluminum and magnesium matrices with carbon or boron fibers) will be investigated utilizing mechanical tension test methods and acoustic emission techniques; these studies will include composites currently being developed. Acoustic emission equipment will be employed, and techniques for the recording of relevant sounds of metals and composites will be developed as needed. The development of new metal alloys and of fiber composites having preferred or improved properties would be dependent on the above considerations.

ADDENDA: Supporting agency address is: DARCOM Materials & Mechanics Research Center, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0016, FABRICATION AND CHARACTERIZATION OF OXYNITRIDE MATERIALS FOR TURBINE COMPONENTS

J.W. MCCAULEY, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4740)

Use of ceramics in Army propulsion and power generation systems requires materials of high thermal shock and oxidation resistance. Further, for complex geometry components such as vanes, ease of fabrication is essential. Oxynitride-based ceramics should provide both properties with simplified processing conditions. The objective of this program, therefore, is to reproducibly fabricate and sinter oxynitride materials, and investigate their properties including thermomechanical and electrical. Their thermal shock and oxidation resistance will also make them desirable crucible materials for molten metal handling in applications such as rheocasting. Pacing materials problems - aircraft - 2500 degrees F turbine components. Thrust - cost reduction.

A systematic study will be carried out on the reaction products and synthesis of compounds in the system silicon-aluminum-metal-oxygen- nitrogen under controlled atmosphere (pressure) and temperature. Various metals will be studied including magnesium, lethium, chromium, etc. Synthesis procedures, using the more readily available silicon dioxide, magnesium aluminate, and aluminum nitride as starting materials, will be studied. Phase equilibria (by diffusion couples) and detailed characterization (including crystal structure determination) will be carried out if necessary. Emphasis will be on scale-up for property measurement and utilization testing.

ADDENDA: Supporting agency address is: DARCOM Materials Mechanics Research Center, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0017, USE OF CERAMICS IN AIRCRAFT ENGINE BEARINGS

M.L. TORTI, Norton Company, *Worchester, Massachusetts* 01606 (DN590035; N00019-75-C-0197)

The objective of this procurement is to investigate the utility of ceramics as a means of increasing performance capabilities, service life or environmental resistance of rolling element bearings for use in turbine engines.

The load life relationships of steel on ceramic and ceramic on ceramic will be evaluated in rolling contact fatigue tests. Aircraft quality precision rolling element bearings with ceramics races and rollers will be designed, fabricated and tested. Silicon nitride and/or silicon carbide are the materials of primary interest.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0018, MATERIALS SUPPORT TECHNOLOGY - ION-MOLECULE REACTIONS

J. WEINER, Dartmouth College, School of Arts & Sciences, *Hanover, New Hampshire* 03755 (DN575345; N00014-75-C-0896)

The Navy has need for increased knowledge of simple gas phase ion- molecule reactions. This work will provide information concerning fundamental processes which are important to better understanding the chemistry occurring in the upper atmosphere, electric discharge lasers in general and excimer lasers in particular, and combustion and flame phenomena.

A new diagnostic technique for studying ion-molecule interactions will be developed. This technique involves combining chemiluminescence and ion-molecular beam studies into a single experiment which measures simultaneously the collision dynamics of the reactive intermediate, the partitioning of energy between translational and internal modes, and the further partitioning of the internal energy among the electronically excited states. In this way a nearly complete characterization of external and internal reaction dynamics can be performed in a single experiment. Coincidence detection will be used.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0019, LUBRICITY PROPERTIES OF HIGH-TEMPERATURE JET FUEL
R.S. SHERTZER, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN596808)

To determine the effects of fuel variables or components on friction, wear, and seizure of pumps and to define ways of improving fuel lubricity. The fuel variables include viscosity, hydrocarbon type, trace elements such as nitrogen, sulfur, and oxygen bearing compounds, and additives.

Determine the effect of fuel variables on various fluids, such as a pure hydrocarbon (dodecane) and jet fuel blends (synthetic jet fuels). Baseline data would be obtained on these fluids by determining their lubricity characteristics in a lubricity tester. The effect of many naturally occurring fuel components could then be evaluated at varying concentrations to determine their effects individually and/or in combination. The accumulation of these data would then be utilized to develop a JP-5 lubricity additive to improve the lubricity characteristics of hydrotreated fuels when required.

ADDENDA: Supporting agency address is: Naval Air Systems Command Propulsion Technology Administrator, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0020, SOLID ELECTRODE STUDIES RELATED TO CORROSION PREVENTION, FUEL CELLS AND BATTERIES
S. BRUCKENSTEIN, State University of New York, School of Arts & Sciences, *Buffalo, New York* 14214 (DF037220; AF-AFOSR-2572-74)

Power generation within the Air Force's operational environment relies on electrochemical power sources such as batteries and fuel cells. Corrosion which detrimentally affects Air Force equipment is also involved in electrochemical reactions. This research involves the study of solid electrode surfaces processes, and the phenomenon that influences these processes. The results will give a better understanding of the adsorption and formation of products on the surface of the electrodes, as well as the potential corrosion sites. This research deals with the phenomenon of 'underpotential' deposition of one metal on another metal substrate. It signifies an adsorption of a metal ion with some charge transfer at a potential more anodic than the equilibrium potential of the ion in contact with its reduced form in the metallic state. The exact description of these adsorbed species on the electrode surface is to be determined. A model is proposed to identify the adions and adatoms as they exist in the double layer adjacent to the electrode, from the species that would exist on the surface of a (crystal) metal atom in contact with the solution. The existence of such species would have considerable significance in understanding the kinetics of metal corrosion, as well as those of metal deposition and electrocrystallization. A new technique known as electrochemical mass spectroscopy is to be applied to the study of problems requiring the detection of gaseous products. Isotope labelling techniques will be used to study the mechanism of hydrazine oxidation in dimethylsulfoxide.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0021, INFLUENCE OF ANNEALING ON THE STRENGTHS OF SECONDARY RELAXATIONS IN GLASSES
M. GOLDSTEIN, Yeshiva University, School of Science, *New York, New York* 10033 (DF037090; AF-AFOSR-2540-73)

AF function - advanced aircraft systems will require new lightweight structural components with improved environmental stability and reliability. Deficiency - the process control of new thermally stable polymeric systems for matrix resins and adhesives is not well understood. Objective - the quantitative relationships between glass structure, relaxation processes, and annealing treatments in the transition range of noncrystalline solids will be determined. How work contributes - it is expected that this research will lead to a better understanding of the glass transition phenomena and generate information for the control of the glass transition temperature and, thereby, polymer processing and the resultant engineering properties.

The dependence of relaxation strength on structural state or fictive temperature in glasses including molecular and hydrogen bonded liquids, fused salts and organic high polymers will be investigated. The beta-relaxation and low-temperature relaxations will be studied by dielectric and calorimetric measurements. The thermodynamic implications of various structural hypotheses will be explored to determine which glass structural theory is supported by the experimental data.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0022, MICROSTRUCTURAL PROCESSES IN THE DEFORMATION AND FRACTURE OF POLYMERS 13566-MS
J.C. LI, Univ. of Rochester, School of Engin. & Appl. Sci., *Rochester, New York* 14627 (DA0E9205; DAAG29 76 G0314)

To study microstructural mechanisms involved in the deformation and fracture of polymeric materials. Relevance - A wide variety of Army materiel, such as fuze components, aircraft canopies, canteens, and personnel armor, are comprised of polymeric materials which have exhibited premature unpredicted failures. The proposed research addresses subjects that will possibly assist in explaining and circumventing such failures.

Study micromechanisms of deformation and fracture in metals and ceramics, including defect analysis, thermally activated deformation, and electron microscopy. Aspects of slip, including morphological details, and activation parameters for slip and craze formation would be studied. Finally, study mechanisms whereby additives and processing methods strengthen and toughen glassy polymers.

ADDENDA: Supporting agency address is: DARCOM Army Research Office Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0023, SINTERED SILICON CARBIDE FOR TURBINE COMPONENTS
R.J. CHARLES, General Electric Company, *Schenectady, New York* 12305 (DN590013)

To develop sintered silicon carbide for high-temperature components of airborne gas turbines.

Processes for pressureless sintering of silicon carbide will be scaled-up for fabrication of specimens suitable for mechanical and thermal tests. Specimens will be characterized for physical properties, strength, response to thermal stress, and resistance to thermal fatigue under simulated gas turbine environments. Property data will be obtained.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0024, TRANSPARENT POLYMERS FOR USE IN HIGH-SPEED AIRCRAFT TRANSPARENCIES
R.P. KAMBOUR, General Electric Company, *Schenectady, New York* 12305 (DN590090; N00019-76-C-0096)

To develop a block copolymer of BPF polycarbonate--dimethylsiloxane with an optimum combination of transparency, toughness and thermal resistance for use as a high-temperature glazing material in high-speed aircraft canopies and wind shields.

Synthesize and purify BPF polycarbonate--dimethylsiloxane block copolymer and evaluate for key properties including tg and heat distortion point, tensile properties between minus 50 and 250 degrees C, abrasion resistance, crazing and transparency.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0025, NAVY VEHICLE DESIGN AND CONSTRUCTION - DISPERSION STRENGHTENED METAL ALLOYS
G.S. ANSELL, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (DN525008; N00014-76-C-0458)

The Navy has a need for high-strength, high-toughness metal alloys for use in a wide variety of components ranging from pumps and compressors to aircraft frame structure and jet engine parts. Improved alloys would result in greater reliability, better performance and/or decreased weight. In this research the investigator will explore mechanisms of strengthening in metal alloys, with emphasis on martensitic steels.

Strengthening mechanisms in martensitic steels will be examined from the following viewpoints: effect of austenite shear strength on formation of the hard martensite; the effect of transformation volume strain on the formation of martensite. Nickel base alloys of the Ni-Cr- Al-Ti-Mo type will be examined to determine the contributions to strengthening of varying mismatch and interfacial energy between gamma and gamma prime, solid solution strengthening, and volume fraction of precipitate. The importance of elastic constant discontinuity between particle and matrix will be examined.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0026, PROTON ACTIVATION STUDIES OF DIFFUSION AND OXIDATION IN SILICON NITRIDE

A.R. COOPER, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (DF680830; F33615-74-C-4029)

AF function - high-temperature propulsion materials, thermal protection materials and power generator materials. Deficiency - failure of materials to perform at high temperatures in oxidizing environments due to degradation of their requisite physical, chemical or mechanical properties. Research - proton activation analysis studies will be made to determine the mode and rate at which the various anions are transported in silicon nitride and in the oxide scales formed on it during oxidation. The studies will include determination of nitrogen transport rates in both the silicon nitride and its silica scale and oxygen transport rates in the silica scale. How research contributes - an understanding of the fundamental transport mechanisms active in ceramics to be used for various high temperature applications is essential if significant long-range improvements are to be made. The data generated by this study will complement the in-house research on work unit 7021-03-37 where the reaction kinetics and detailed microstructure analysis resulting from the same high-temperature oxidation process have been determined. The resulting mechanistic understanding of the degradation process can lead to modification in material composition, surface condition, etc., in a scientific manner to improve the high-temperature behavior of silicon nitride.

Proton activation will be used as a means of detecting super 18 o through the use of super 18 o (p, alpha) super 15 n reaction and detection of the energetic alpha particles produced. This method, when combined with serial sectioning, provides a straight forward means of determining a super 18 o concentration profile; the number and energy distribution of alpha particles produced for a given proton flux is used as a measure of the super 18 o concentration within each successive section.

ADDENDA: Supporting agency address is: AF Materials Laboratory LLM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0027, MATERIALS SUPPORT TECHNOLOGY - EFFECT OF RARE-EARTH ADDITIONS ON MECHANICAL PROPERTIES OF HIGH-STRENGTH STEEL

C.S. KORTOVICH, Thompson Ramo Wooldridge Inc., *Cleveland, Ohio* 44117 (DN475430; N00014-74-C-0365)

The objective of this research is to determine if rare-earth additions are beneficial to the mechanical properties of high-strength steels used in naval aircraft structures.

Alloying additions of the rare earths lanthanum and cerium are to be made to high-strength steels. The effect of these additions on microstructure, workability, and mechanical properties are to be determined by standard metallurgical techniques.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0028, CERAMIC TRIBOLOGY - SILICON NITRIDE

H. DALAL, S K F Industries Incorporated, *Norristown, Pennsylvania* 19406 (DN590095; N00019-76-C-0147)

To determine parameters such as surface distress, lubication requirements, friction and wear behavior, etc., needed for the design of silicon nitride elements as future aircraft turbine engine bearings.

This phase aims to develop a correlation between lapping conditions and severity of silicon nitride surface damage and to study the mechanism of material removal under various lapping conditions as they affect ball bearing performance.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0029, NAVY VEHICLE DESIGN AND CONSTRUCTION - DEFORMATION BEHAVIOR OF METAL MATRIX COMPOSITE MATERIALS

A. LAWLEY, Drexel University, School of Engineering, *Philadelphia, Pennsylvania* 19104 (DN723636; N00014-76-C-0205)

This research effort is directed towards increasing our understanding of how interfacial structure affects mechanical properties of composite materials. The researchers will examine the effects of elevated temperature and forging on the structure and properties of metal-matrix composites. The work is aimed primarily at future applications of composites in hot sections of jet engines.

This acceleration will provide equipment for grinding precision test specimens from nickel and cobalt-base composite materials. The investigators will examine the effects of high-temperature exposure on structure and mechanical properties of filament-reinforced composites (nickel matrix with molybdenum filaments) and directionally solidified eutectic composites (cobalt-chromium-carbon system). Thermal stability, including thermal cycling, will be followed in both types of composites and such factors as structure coarsening and diffusion-barrier interfaces examined. Forging of these composites will be examined to determine variables which influence formability.

ADDENDA: Supporting agency address is: Office of Naval Research 471, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0030, FLUORINATED SYNTHETIC HYDRAULIC FLUIDS FOR SUPERIOR FIRE RESISTANCE

H. LEE, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN581137)

To provide a new class of synthetic fluids with superior fire resistance properties for application to military aircraft hydraulic systems.

Selected aircraft fluids will be chemically modified to incorporate fluorine atoms into the existing polymer chain. For example, a synthetic hydrocarbon oligomer which is less flammable than a corresponding petroleum fluid will be altered to accept fluorine. By selective addition of the fluorine-containing functional groups, performance properties such as flammability could be substantially improved. In addition, alkylated silicones which are relatively flammable fluids will also be investigated.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0031, ADVANCED MATERIALS FOR AIRCRAFT ENGINES

R.G. MAHORTER, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN833259)

To develop the materials and associated processing necessary for the construction of advanced aircraft engines. The development objectives will include not only the traditional higher performance and thrust-to-weight ratio but also reduced cost (both acquisition and maintenance), better survivability, and improved nondestructive test methods for defects unique to engine materials.

Vanadium alloys will be evaluated for potential engine applications. This system has the advantages of low density, good ductility, and high melting point. The maximum use temperature in the uncoated condition will be established. Mechanical properties at that temperature will be compared with those of competing systems. A decision will be made in FY-74 on the future of the vanadium program. If the mechanical properties of the first-generation alloys are close to or above those of alternate systems, an expended program of alloy modification, thermal-mechanical processing, and coating development will be initiated. In the event that properties are only marginal, a reduced program directed to the development of precipitation-hardened alloys will be undertaken.

ADDENDA: Supporting agency address is: Naval Air Systems Command Aerodyn., Struct, & Mater. Admin. (302A) Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0032, ADVANCED COMPOSITE HIGH TEMPERATURE
T.F. NEU, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN481024)

Analytically synthesize and design an optimal advanced composite primary structural component suitable for the high-temperature environment of a high-performance vehicle. Assess design alternatives and exploit advantageous properties of boron-aluminum material to meet established design requirements. Provide a basis for in-house prototype fabrication, laboratory evaluation and flight demonstration.

From an evaluation based on design requirements, potential weight and performance improvements, fabrication complexity and cost, and opportunity for flight demonstration, select a primary structural component for an analytical design/synthesis effort. Computerized procedures will be employed to generate an aerodynamically and structurally optimized design, which will be used in an in-house prototype fabrication effort. Laboratory evaluation will be performed, and subsequent flight demonstration is envisioned.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0033, HIGH-TEMPERATURE FIRE-RESISTANT HYDRAULIC FLUID FOR FUTURE NAVAL AIRCRAFT
L. STALLINGS, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN581470)

To develop a high-temperature (350 F to 400 F) fire-resistant hydraulic fluid suitable for use in future aircraft hydraulic system designs to allow increased performance and to reduce incidence of aircraft fires.

A synthetic polymeric fluid containing repeated silicon-oxygen molecular units will be utilized as a base fluid in this program because of its inherent fire-resistance properties. Antiwear additives will be developed suitable for use with this base fluid in order to impart improved lubricating qualities in the 350 F to 400 F temperature range. The resultant candidate fluid will be completely characterized in regard to both its chemical and physical properties so that future aircraft hydraulic systems can be designed around the properties of this fluid and take advantage of its fire-resistant nature.

ADDENDA: Supporting agency address is: Naval Air Systems Command Tech. Admin. (Aero and Structures), Washington DC

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0034, PROCESSING VARIABLES WHICH AFFECT ADHESION OF ORGANIC COATINGS TO NAVAL AIRCRAFT
A.E. FEATHERSTON, L T V Aerospace Corporation, *Dallas, Texas* 75222 (DN590009; N00019-75-C-0087)

To establish the processing variables and the tolerances therein associated with the preparation of metal aircraft surfaces for paint application and determine the relationship between theory and the properties of the subsequently applied organic coating (including sealants), particularly as related to coating adhesion.

Variations in surface preparation will be studied by preparing specimens utilizing commonly-encountered processing conditions, such as anodizing, followed by the standard Navy aircraft finish system (as well as the finish system employing an elastomeric preseal). Quantitative adhesion measurements will be made after the finish system has cured to determine the acceptable spread of controllable conditions to achieve optimum properties of the finish system.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0035, INVESTIGATION OF REINFORCED THERMOPLASTICS FOR NAVAL AIRCRAFT STRUCTURAL APPLICATIONS
J.T. HOGGATT, Boeing Company, *Seattle, Washington* 98108 (DN590103; N00019-76-C-0171)

To evaluate the properties of hybrid fiber-reinforced thermoplastics for naval aircraft structural application.

Develop procedures for the impregnation and fabrication of graphite and supplementary fiber-reinforced thermoplastics. Evaluate the mechanical, physical and environmental resistance properties of these composites. Develop methods of improving graphite fiber to resin bonds and resistance of graphite thermoplastics to aircraft fluids.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, SOSTEL/GPMS INTERFACE UNIT
J. GROSS, Sci Systems Incorporated, *Huntsville, Alabama* 35802 (DN781229; N62269-76-C-0081)

To design and fabricate a SOSTEL III MUX/DEMUX terminal which will be integrated into a SOSTEL/GPMS interface unit and develop necessary software to allow communication between SOSTEL III and other avionics on the GPMS buses. This contract supports work unit ZA101, agency accession no. DN681080.

Adapt existing circuit designs to the physical limitations imposed by the configuration of the SOSTEL/GPMS interface unit. Develop electrical interface characteristics. Develop message structure in cooperation with avionics subsystem developers.

ADDENDA: Supporting agency address is: NADC Air Vehicle Technology Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0002, COMMUNICATIONS - VECTOR ELECTRIC FIELD MEASUREMENTS
F.S. MOZER, Univ. of California, Space Sciences Laboratory, *Berkeley, California* 94704 (DN724005; N00014-75-C-0294)

A knowledge of the electric field surrounding the earth will serve as a foundation for future design of communications and surveillance systems. By providing direct measurements of the intensity and structure of the electric field, electromagnetic wave propagation may be predicted. In addition, basic knowledge required for the understanding of electromagnetic noise and extraterrestrial corpuscular radiation effects will be gained.

A vector electric field experiment has been designed and built to be flown on an Air Force satellite S3-3 expected to be launched this year. The launch into a polar orbit with an apogee of 5000 miles will enable vector electric field measurements in a previously unexplored region. This launch is part of DOD STP flight 74-2.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0003, DEVELOPMENT AND EVALUATION OF ADVANCED PARACHUTE CANOPY DESIGNS

J.D. BOONE, U.S. Navy, Aerospace Recovery Facil., *El Centro, California* 92243 (DN937028)

To improve consistency of parachute canopy operation, simplify manufacturing procedures, improve quality control, reduce opening shock loads, reduce weight and bulk and improve operational envelope as a result of basic design capability. More specifically, a parachute canopy consisting of much less than the approx 140 pieces in the present 28-ft flat canopy; reduction in operating forces by use of variable-porosity and energy-absorbing materials; maintain, as a minimum, the present capabilities; reduce weight and bulk by 20%.

Circular woven fabric containing all necessary reinforcing tapes and ripstops and integrally woven parts; knit fabric wide enough to produce a canopy having from one to three pieces; reduction in opening force by use of canopy fabric having a force-variable porosity (high permeability under high load to reduce shock, low permeability under low load to reduce rate of descent); extending the parachute performance envelope by utilizing the above to give quick opening at low speeds and survivable force when opening at high speeds; reduction in weight and bulk will be achieved by eliminating seams and tapes.

ADDENDA: Supporting agency address is: Naval Air Systems Command, (AIR-340B), Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0004, TRANSONIC COMPRESSOR INVESTIGATION

M.H. VAVRA, U.S. Navy, Postgraduate School, *Monterey, California* 93941 (DN498063)

To investigate the flow phenomena in impulse-type transonic compressor stages to establish more precise performance prediction methods.

To design, build, and install a transonic compressor test rig which permits the determination of the flow phenomena ahead and after each row of blades with modern instrumentation.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0005, RADIATION EFFECTS IN HGCDTE

J.A. NABER, Intelcom Industries inc., *San Diego, California* (DF901730; F19628-75-C-0170)

AF function - surveillance, detection and weapons delivery. Deficiency - nuclear radiation-induced changes in optical and electrical properties of infrared (ir) detector materials can alter the performance characteristics of ir detectors. Objective - determine the radiation- induced changes in optical and electrical properties of HgCdTe. How research contributes - this investigation will provide data needed to predict and assess the performance of ir detectors exposed to nuclear radiation and to evolve techniques to harden detectors to nuclear radiation.

Uncompensated, low carrier density long wavelength n-type HgCdTe will be irradiated with electrons, neutrons and gamma rays at 10 degrees K. Radiation-induced changes in carrier density and mobility and carrier lifetime will be measured and analyzed relative to the performance of photoconductive detectors. Similar measurements will be made on short wavelength materials. Photovoltaic devices will be irradiated at 80 degrees K and effects on their performance will be related to radiation- induced changes in material properties.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0006, SPACECRAFT CHARGING EXPERIMENTS

S.E. DEFOREST, Univ. of California, Graduate School, *San Diego, California* 92037 (DN675252; N00014-76-C-0432)

The objective is to examine spacecraft charging effects at synchronous altitude. Spacecraft charging is a probable cause of failure of electronic circuits and could affect naval satellite communications systems at ultrahigh frequency. A space measurement program will be carried out to specify design criteria and test procedures which can be used to assure that satellites will not be adversely affected, when exposed to electrical charging by the space environment.

A particle detector to yield energy and angular measurements of electron and proton fluxes, between 1 eV and 70 KeV, will be designed and tested for flight on the Air Force scatha spacecraft, launch date April 1978. Data from this detector will be used to define the properties of the ambient plasma and particle flux prior to and during periods of satellite charging and allow for the interpretation of the charging phenomena observed.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0007, 1.06 MICROMETER APD/LOW NOISE PREAMP DEVELOPMENT

R. EDEN, Rockwell International Corp., *Thousand Oaks, California* 91320 (DF101090; F33615-75-C-1165)

The technology will be developed for hybrid integration into a single package of low irradiation level, 5 mHz bandwidth optical receiver peaked for 1.06 micrometer spectral response. This optical receiver is being developed to meet the 1.06 micrometer, 5 mHz laser line scan requirement of a receiver irradiation level of 0.224 nanowatts average power. Present 5 mHz bandwidth, 1.06 micrometer silicon avalanche photodiode receivers are limited by a low ac quantum efficiency of 10 at 1.06 micrometers. When the silicon photodiode is combined with a standard 5 mHz preamplifier which has an rms thermal noise of 2 picoamps/hz one half, the sensitivity of the receiver is limited to 3.13 times 10 minus 9 watts at a s/n of 5. Under contract F33615-74-C-1030, AFAL has developed a GaAs/GaAsSb heterojunction which has 95 percent quantum efficiency at 1.06 micrometers when antireflection coated.

Three requirements will be met to increase the optical receiver sensitivity at 1.06 micrometers from an irradiation level of 3.13 nanowatts down to 0.224 nanowatts average power at the receiver. The quantum efficiency at 1.06 micrometers must be 95 percent. This has already been achieved in a GaAs/GaAsSb heterojunction (contract F33615- 74-C-1030). The GaAs/GaAsSb photodiode average avalanche gain must be increased from 5 to 30. To increase the avalanche gain to 30, the junction depletion width uniformity will be improved by ion implantation of Zn doping to move the p-n junction away from the GaAs/GaAsSb heterojunction interface. The rms thermal noise current of 2 picoamps/ Hz one half for a 5 mHz preamplifier must be lowered to 0.14 nanoamps rms thermal noise current. Since the GaAs/GaAsSb photodiode has a capacity of less than 0.3 picofarads, a low capacitance GaAs FET can be hybrid integrated with the GaAs/GaAsSb photodiode into a single low capacitance package with an rms thermal noise current of 0.14 nanoamps in the preamplifier. In the first task of a 3 task effort the average avalanche gain will be 10, the bulk dark current will be 10 nanoamp cooled, and the preamplifier developed as stated above. This will give the first milestone sensitivity of 4.86 times 10 minus 10 watts at a s/n of 5.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHO Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0008, FLUIDIC OVERSPEED LIMITER FOR AIR CYCLE MACHINES

D. SCHAFFER, Garrett Corporation, *Torrance, California* 90509 (DN590077; N00019-76-C-0500)

The objective of this program is to demonstrate the feasibility of a fluidic overspeed limiter for aircraft environmental control system air cycle machines.

Control requirements will be defined for the specific system followed by design, fabrication and laboratory test of the breadboard system.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0009, POWER AMPLIFIER MODULES
V. GARBUSHIAN, Power Hybrid Incorporated, *Torrance, California* 90501 (DN581099; N62269-73-C-0657)

To develop a 250-watt peak pulse power amplifier module that can be used as a building block in a 1000-watt amplifier for TACAN, IFF and new link in the LX-band. This contract supports work unit DV701, agency accession no. DN233250.

A contract for a single emitter ballasted multicell transistor utilizing gold metallization was awarded in June 1973. The transistor along with matching 50 ohm input and output networks was to be placed in a 5 cu in. module. Contract calls for delivery of 12 modules.

ADDENDA: Supporting agency address is: Naval Air Development Center, Aero Electronic Technology Dept. (2031) Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0010, EXPLORATORY RESEARCH INVESTIGATION OF P-STATIC ELECTROMAGNETIC RADIATIONS FROM AIRCRAFT IN FLIGHT
D.E. STEFFEN, Univ. of Denver, Denver Research Institute, *Denver, Colorado* 80210 (DN590050; N00019-74-C-0334)

To determine the static (corona) radiation spectrum of aircraft in flight.

Phase I consists of a literature survey and simple laboratory experiments to determine the frequency spectrum and magnitude of static (corona) signals from flight aircraft. This phase was completed in FY 75. Results indicate that signals are present along with atmospheric noise. The streamering noise does not show as good as the corona noise. Measuring techniques are needed which will identify signals properly. Background noise varies in different time intervals, but signals can be isolated. Task II will continue investigation in airports, bases, ships and missile sites. Test equipment will be modified for better signal identification.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0011, SWIRL BURNING AUGMENTATION FEASIBILITY
R. REILLY, United Aircraft Corporation, *Hartford, Connecticut* 06118 (DN596800; N00019-72-C-0612)

The objective of the augmentation program is to demonstrate the feasibility and performance capability of a new combustion concept (swirl burning). The program is aimed at documenting improvements in the areas of reliability, hot and cold pressure loss, fuel preparation, combustion performance, and system integration.

Conduct technology studies to establish augmenter requirements and provide guidance for design and rig test configurations. These analytical studies will consider a range of potential applications. Rig testing of the three configurations listed as follows to provide sufficient basic data to allow evaluation of this concept for an advanced augmenter application: (a) TF30-P-412 V-gutter augmenter; (b) vortex burning and mixing (VORBIX); (c) vaned cascade. Prepare a full- scale design configuration presenting the optimum system determined from the analytical study and the rig test program.

ADDENDA: Supporting agency address is: Naval Air Propulsion Test Center Research and Technology Group (PE4), Trenton, NJ 08628

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0012, RADIOMETRIC DETECTABILITY OF ANOMALOUS TROPOSPHERIC REFRACTION
J.P. HOLLINGER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680162)

To develop a real-time, in situ capability to detect the presence of anomalous refraction conditions using microwave radiometry. Successful completion of this work will significantly improve the performance of the Navy's surveillance radars and communication system.

The refractive atmospheric regions which cause ducting, shading and radar holes also change the effective direction of reception of a radiometric system and can result in a significant change in the measured radiometric temperature. High-resolution, scanning, multifrequency microwave radiometric measurements of dispersive atmospheric regions will be made to investigate and quantify this behavior. Optimum system parameters will then be specified for an operational anomalous dispersion detection system.

ADDENDA: Supporting agency address is: Naval Air Systems Command, (AIR-370C1), Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0013, XUV SPECTRORADIOMETRY - SOLAR & ATMOSPHERIC PROCESSES AFFECTING COMM. & SURVEILLIANCE (ABBREV)
W.R. HUNTER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN580008)

The objectives are: (1) to predict and evaluate the effects of a medium disturbed, or ionized, by XUV radiation on the propagation of electromagnetic radiation for communications and surveilllance purposes, and (2) to study and predict the effect of high-power XUV radiation on coatings and windows, and large optics for military applications. Data obtained are necessary to design and evaluate experiments for interpreting effects of radiation on the terrestrial atmosphere which, in turn, affects communications and surveillance systems, i.e., long- distance radar, etc., and to understand the interaction of XUV radiation with solids.

Photoelectric yields, diffraction grating characteristics, extinction coefficients, and transmittances and reflectances of coatings and materials are studied in bulk and evaporated film form. New instrumentation and experimental methods are developed and evaluated.

ADDENDA: Supporting agency address is: Naval Research Laboratory (7000), Washington, DC 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0014, COMPUTER GENERATED VISUAL DISPLAYS FOR TRAINING
J.L. BOOKER, U.S. Navy, Computer Laboratory, *Orlando, Florida* 32813 (DN494005)

Develop CGI applications in both TV and calligraphic display formats, and identify advantages and limitations of each type when applied to training applications such as carrier landing, weapon delivery, and general aerial maneuvers. Significant savings can be achieved where calligraphic displays can replace the more general and expensive TV-type CGI. Investigation will include interactive simulator control with on-line control and replay of trial scenarios, stylized sensor (radar/sonar) displays, and simulated operational displays.

(Jan 76 - Jul 76) contract award for procurement of a real-time continuous-tone TV CGI system was made on 20 May 1976 to General Electric Co, Daytona Beach, Florida. Delivery is scheduled for October 1978. An in-house report IH270 describing the math model and program changes required to provide simulation of fixed-perspective zoom lens simulation of range changes is being prepared for publication.

ADDENDA: Supporting agency address is: Naval Air Systems Command Instrumentation and Flight Controls, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0015, FLIGHT SIMULATION SYSTEM TEST TECHNOLOGY
W.T. HARRIS, U.S. Navy, Computer Laboratory, *Orlando, Florida* 32813 (DN494045)

Derive acceptance test procedures which adequately evaluate engineering performance of operational flight trainers. The number of tests performed will be reduced by eliminating redundancies.

(a) To identify those functions and characteristics of an operational system which describe the engineering performance of that system. (b) To obtain operational performance data relat-

ing to those characteristics. (c) To identify those tests which provide the best measures of engineering performance and characteristics of OFT's and to specify, design, and implement the selected tests on TRADEC. (d) To perform the tests, to compile, to analyze, and to compare OFT performance with operational data. (e) To recommend engineering tests, equipment and procedures for incorporation into test and acceptance sections of OFT specifications.

ADDENDA: Supporting agency address is: Naval Air Systems Command Instrumentation and Flight Controls, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0016, COMMUNICATIONS - PLASMA STABILITY AND HIGH-FREQUENCY COMMUNICATIONS

M.B. LEWIS, Northwestern University, School of Technology, *Evanston, Illinois* 60201 (DN524249; N00014-76-C-0089)

The objective is to carry out research on plasmas and their interaction with electromagnetic fields. Such interactions are important in that, for example, the application of magnetic fields to moving plasmas provides a means of converting the thermal energy of combustion of fission directly to electrical power without the use of mechanical generators. Also, plasma stability and confinement govern the possibility of thermonuclear fusion power generation. Further ionization effects in plasmas are important for radio-frequency communications and telemetry from space and reentry vehicles. The work is thus of interest to the Navy in communication systems via the ionosphere, power sources, in ballistic missile and atomic weapons effects, satellite surveillance, and in gaseous electronic devices.

Ongoing work involves studies of radiative transfer in plasmas to determine the absorption and emission of energy both at the macroscopic and internal levels. The problem of thermal fluctuations in hydrodynamics is being examined; namely, the possibility of constructing equations that include fluctuations of the variables, number density, velocity, and internal energy. Work is continuing on the ionization of a weakly ionized gas produced by a strong electric field.

ADDENDA: Supporting agency address is: Office of Naval Research 421, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0017, NAVAL WEAPONS ELECTRONICS - ELECTROMAGNETIC COUPLING THROUGH APERTURES IN CYLINDRICAL STRUCTURES

R. MITTRA, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DN575397; N00014-75-C-0293)

The coupling of electromagnetic signals, such as radar, into cylindrically shaped structures such as naval aircraft and missiles presents an important problem in the design of sensitive electronic circuits and systems employed in the guidance of these weapons. This program will yield practical estimates of the amount of such coupling.

This effort will carry out an accurate analysis of the aperture coupling phenomena in long cylindrical structures whose radii are comparable to the wavelength of the incident field. It is proposed to employ accurate and efficient numerical and analytical techniques which have been expressly developed for solving the scattering problems encountered.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0018, FLOW ANALYSIS IN THE EXIT REGION OF A SUPERSONIC COMPRESSOR CASCADE

J.R. FAGAN, General Motors Corporation, *Indianapolis, Indiana* 46206 (DN590060; N00019-75-C-0385)

To develop an exit flow calculation for supersonic compressor cascades.

An exit flow analysis will be developed which together with already existing entrance and passage flow calculations will permit supersonic cascade analysis for airfoils with blunt leading and trailing edge flows, including rotational flows found in actual compressor casacdes. The resulting computer programs will be tested by comparsion with experimentally measured cascade data.

ADDENDA: Supporting agency address is: Naval Air System Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0019, HIGH-ENERGY Q-SWITCH

W.W. HUGHES, Westinghouse Electric Corp., *Baltimore, Maryland* 21203 (DF103160; F33615-76-C-1015)

The trend in future AF laser target designators and countermeasures is towards higher energy per pulse (more than 0.5 j/pulse). The simplest approach to achieve this is to use higher energy storage laser materials in combination with a thermal optic distortion relief design. This makes it even more important that the q-switch have a high damage threshold. The objective of this program is to develop a high energy density resistant q-switch for 1.06 micron lasers delivering more than 0.5 j/pulse. In order to build simple reliable laser sources for future 1.06 micron target designator and countermeasure systems, a high energy density resistant q-switch will be required. The design of the q-switch must allow use of pim and doublet coding techniques. The tentative objective performance requirements are as follows: damage threshold, more than 500 mw/cm2, extinction ratio, more than 300/1, repetition rate, to more than 30 pps. The switching speed must be fast enough to allow generation of 20-30 nsec pulses.

Several approaches to this program are possible. The most straightforward approach would be to simply attempt to improve the performance of the kd p q-switch. This approach does not offer much in the way of future growth possibilities. The use of a new electrooptic material such as CD A is a definite possibility. This material has a potentially high damage threshold and low voltage requirements. However, there are difficulties in growing satisfactory crystals. The material growth problems are being addressed in another program. A third very promising approach is the FTIR (frustrated total internal reflection) q- switch. The basic feasibility of this approach has been demonstrated and the future growth possibilities are excellent.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHO Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0020, CAVITY DUMP-PTM ND LASER

J.L. WENTZ, Westinghouse Electric Corp., *Baltimore, Maryland* 21203 (DF096470; F33615-74-C-1011)

To develop methods of obtaining short-pulse, high-repetition-rate operation from continuously pumped solid-state lasers at 1.06 microns. Pulse lengths must approximate those of a laser rangefinder or target designator return. Thus we are interested in obtaining pulses of less than 100 nsec duration with an objective of 50 nsec. Repetition rates of interest are in the 50 kHz to several mHz region. This includes an unstable region where conventional methods of q-switching or cavity dumping are not applicable. A further objective will be to develop a laboratory prototype device operating a one mHz repetition rate with 25 watts average power output.

Investigate theoretically and experimentally methods of obtaining short-pulse operation at fifty kHz to several mHz repetition rate. The principal limitations to obtaining high-repetition rate, short-pulse operation are thermal-optic effects and switching media. These problems are strongly interacting and must be carefully studied. Acoustooptic switching tends to require low-order mode operations (at the expense of increased acoustic power) while electrooptic switching is quite sensitive to thermal stress-induced birefringence. A significant portion of this program must be devoted to optical switching methods and materials. Based upon the results of this investigation a laboratory prototype device will be developed and delivered.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHO Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0021, MISSILE DOME BOUNDARY LAYER STUDIES
R.L. VOTSINET, U.S. Navy, Flight Measurements Division, *Silver Spring, Maryland* 20910 (DN685096)

Develop a technique for predicting the boundary-layer flow field on missile domes, initially determining the effect of surface roughness on boundary layer transition and heat transfer.

Initially an exploratory study both analytical and experimental will be made to identify the basic parameters and relationships that govern the flow development and transition. Analytical studies include adaptation of a modern numerical computation method to describe the missile dome flow field. Experimental studies include the measurement of instantaneous velocities with the laser velocimeter to obtain the laminar and turbulent transport parameters. The studies will be made in both subsonic and supersonic flight range with controlled variation of basic parameters to refine the prediction method for missile dome boundary layer flows.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Department of the Navy, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0022, WEAPONRY - LASER DISCHARGE STUDIES
J. MANGANO, Avco Corporation, *Everett, Massachusetts* 02149 (DN575034; N00014-75-C-0062)

The objective of this program is to develop electrical excitation techniques for high-power visible and ultraviolet lasers which may be used for laser reconnaissance, surveillance.

The contractor will design and fabricate a laser cavity and associated discharge circuitry for use in a 10 x 10 x 100 cm large-scale KRF laser eexperiment.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0023, NAVY VEHICLE DESIGN AND CONSTRUCTION - A/C STABILITY AND CONTROL ANALYSIS OF AIRCRAFT AT HIGH ANGLE OF ATTACK
R.K. MEHRA, Scientific Systems Inc., *Lexington, Massachusetts* 02173 (DN675668; N00014-76-C-0780)

At high angles of attack the flying qualities of most high- performance aircraft deteriorate due to undesirable characteristics such as roll coupling, directional departure, and wing rock. These characteristics significantly reduce tracking capability and maneuverability and often lead to loss of control and difficult or impossible recovery problems. The objective of this program is to develop an analytic framework of study for the high angle of attack stability and control problem, and to identify designs of departure preventing control system.

In this work unit research into catastrophe theory will be conducted to examine the applicability of this relatively new branch of mathematics to providing an analytic means of studying the global stability properties of aircraft flying at high angles of attack. In particular this research effort will attempt to validate the conjecture that catastrophe theory can explain such observed nonlinear high-angle- of-attack phenomena as pitch-up, roll coupling, directional divergence wing rock and transonic trim change. Catastrophe theory involves the study of equations whose solutions branch or bifuracate as a parameter in the equation varies.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0024, 4 KHZ SIMULATOR MODIFICATIONS
R. ZAORSKI, Dynatron Corporation, *Waltham, Massachusetts* (DF722230; F30602-76-C-0082)

The objective of this effort is to modify the DICEF's wireline simulator to provide the following added capabilities: 1. phase hits, 2. amplitude hits, 3. harmonic distortion, 4. bipolar phase jitter and 5. digital noise source. Also improvements and simplification in the use of the simulator will be provided.

Based on Dynatron Corporation's unsolicited proposal this effort will be awarded sole source, to Dynatron. This company has conceived the changes required and they will implement these over an 8-month contract effort.

ADDENDA: Supporting agency address is: Rome Air Development Center DCL, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0025, ATMOSPHERIC EFFECTS ON RADAR RANGE AND ANGLE SPECIFICATION AND CALIBRATION
L. BURKE, Regis College, Undergraduate School, *Weston, Massachusetts* 02193 (DF247920; F19628-76-C-0255)

AF function - advanced radar and satellite navigation systems. Deficiency - the ionosphere introduces range and angle errors in the SPADATS tracking radars and in planned navigation systems. Objective - develop and validate models, computer algorithms and on-site specification procedures to provide real-time specification of range and angle tracking errors and to provide post-event calibration of tracking and navigation systems using actual data obtained at ground-based ionospheric stations, obtained from in-situ satellite measurements and obtained from SPADATS radars. How research contributes - improve radar tracking and satellite navigation systems by developing algorithms and procedures to use on-site measurements to update models of expected mean range and angle error.

Investigate range and angle errors of tracking radar and navigation systems. Develop relationships to on-site measurements of ionospheric parameters. Develop and validate computer algorithms for real-time and post-event corrections.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0026, PERFORMANCE SPECIFICATIONS FOR SIMULATED AVIONICS MAINTENANCE TRAINER
R. DANIELS, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DN594004; N61339-75-C-0085)

Develop 'front-end' data required to enter prototype development of a maintenance trainer/simulator for the electronic systems area. This trainer approach is designed to improve and shorten NAMTRADET/OJT training.

Using 100% simulation of the operational gear and its associated electronic test set, perform the following steps: (a) Task analysis: identify and/or develop relevant tasks required to maintain the selected gear and its associated test set. (b) Performance specifications: develop preliminary data for engineering design. Specificity to be done to the level of instructor and/or trainee console layout. (c) Cost- benefit analysis: assess presumed costs and benefits accruing from use of proposed simulator trainer; compare results with those obtained where operational gear only is used as a training device.

ADDENDA: Supporting agency address is: Naval Training Equipment Center Human Factors Lab, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0027, FLUIDIC FLIGHT CONTROL SYSTEM
J. HEDEEN, Honeywell Incorporated, *St. Paul, Minnesota* 55113 (DN590117; N00019-76-C-0272)

The objective of this program is to determine the feasibility of a fluidic flight control system for a UTTAS/LAMPS class helicopter.

This shall be accomplished by defining, analyzing, and evaluating a fluidic flight control system based on UTTAS/LAMPS requirements.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0028, RELIABILITY TEST AND EVALUATION OF MIL-M
G. JOHNSON, McDonnell Douglas Astro. Corp., *St. Louis, Missouri* 63166 (DF736730; F30602-76-C-0371)

The objective of this effort is to provide a detailed study of high-reliability (MIL-M-38510 class B or if not available, the nearest equivalent) linear microcircuits to assure adequate test methods, reliability prediction, and specification for high-reliability Air Force electronics.

The program will test statistically significant quantities of several types of linear microcircuits using standard reliability test techniques and MIL-M-38510 type test conditions to obtain data of estimated device failure rate, temperature/voltage acceleration factors and identify all observed failure mechanisms in detail. The test vehicles shall include operational amplifiers, voltage regulators and voltage comparators as a minimum. A comparative analysis of the effectiveness of the various burn-in configurations shall be done to determine the best approach where several alternatives are available. The electrical test procedures of MIL-M-38510 shall be studied in detail to define any problem areas and inadequacies which may exist. Consideration shall be given to problems often encountered when implementing parametric tests in an automated environment such as test time, sequence, soak time, and test fixture wiring restrictions. The approach shall include selection of specific test vehicles from several sources, design of test plan and evaluation of part performance using conventional and special test methods including high-stress tests. Analysis of device construction and detailed failure analysis shall be done.

ADDENDA: Supporting agency address is: Rome Air Development Center RBR, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0029, ENGINEERING SERVICES TO SUPPORT MICROPROCESSOR APPLICATIONS PROJECT

A. LISIKY, Semcor Incorporated, *Cherry Hill, New Jersey* 08034 (DN781198; N62269-76-A-0060)

Develop matrices that relate microprocessor types and capabilities to applications in avionics processing areas. This contract supports work unit ZC201, agency accession no. DN 681082.

The contractor shall perform the following tasks: (a) obtain functional and performance requirements of a subsystem, (b) identify potential applications areas, (c) estimate memory size, word structure, throughput rates from algorithms of subsystem, (d) establish extent of commonalities and differences between subsystems, (e) correlate processing characteristics with proposed family of microprocessors, and (f) produce matrices that relate the performance capabilities with appropriate family members.

ADDENDA: Supporting agency address is: Naval Air Development Center Aero-electronic Tech Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0030, RPV LAUNCH/RECOVERY

K. MENACKER, U.S. Navy, Engineering Department, *Lakehurst, New Jersey* 08733 (DN696003)

To develop an optimum mini-RPV launch and recovery system for use on non-aviation-type ships.

Survey the field to search out and identify the characteristics of the RPV, both established and planned, which relate to launch and recovery. Establish design parameters for a launch and recovery system. Design, manufacture, install and test a prototype launcher and recovery system. Establish firm launcher and recovery system specifications.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0031, MAGNETIC RESONANCE GYRO-SIGNAL/NOISE ENHANCEMENT

J.H. SIMPSON, Singer Company, *Little Falls, New Jersey* 07424 (DN590140; N00019-76-C-0440)

To improve the performance of the magnetic resonance gyro by improving the gyro signal-to-noise ratio. Conduct tests to assess the performance capability of the device and determine the areas in which follow-on development efforts must be concentrated.

This effort involves: (a) investigation of the use of light at 185.0 nm to monitor the magnetization; (b) investigation of a multiple- passage faraday rotation technique; and (c) investigation of the use of solid-state photodetectors.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0032, THEORETICAL STUDIES OF WAVE PROPAGATION IN LAMINAR BOUNDARY LAYERS

A. FERRI, New York University, School of Science & Engin., *New York, New York* 10003 (DN675088; N00014-76-C-0183)

The instability of laminar boundary layers and the associated transition to turbulence are extremely complex phenomena that have major effects on the performance of aircraft and missiles throughout the speed range. An increased understanding of these occurrences, coupled with an improved predictive capability, could lead to a significant improvement in vehicle performance, particularly as regards range and fuel economy. The proposed research will study, theoretically, the propagation of waves through laminar boundary layers at high subsonic speeds, emphasizing the nonlinear interaction of the wave with the boundary layer.

The 'stability' of the laminar boundary layer will be studied, by finite-difference techniques, for the flow past a flat plate at high subsonic speeds. The boundary layer will be represented, initially, by a rotationally inviscid flow. Disturbances will be introduced at the upstream, downstream and outer boundaries. The propagation and distortion of the disturbances, and the associated modifications of the flow will be calculated using the complete inviscid compressible flow equations. The influence of disturbance amplitude and wavelength will be investigated.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0033, THE INFLUENCE OF COMPLIANT SURFACES ON THE STRUCTURE OF TURBULENT FLOWS

M. LESSEN, Univ. of Rochester, School of Engin. & Appl. Sci., *Rochester, New York* 14627 (DN575369; N00014-75-C-0870)

Viable techniques for reducing the turbulent skin friction of wings and bodies at all speeds have been a perennial goal of fluid dynamic research since the evolution of such techniques would lead to, for example, improvement in the performance of aircraft, missiles and ships. The proposed research will be a theoretical study of the coupling of the shear waves in a compliant surface with a turbulent boundary layer and the effects of the interaction on the Reynolds stresses, stresses which are directly related to the skin friction.

Recent careful experimental measurements in air have indicated significant reductions in turbulent skin friction when the test surface was made compliant. Though there are evolving empirical correlations of the data which are useful for planning future research programs and for examining possible applications, little fundamental information exists to explain the phenomenon. The proposed research will examine a possible mechanism for explaining the drag reduction and possibly lead to a better insight into material selection for maximizing the gains.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0034, 94 GHZ PARAMETRIC AMPLIFIER

H. OKEAN, L N R Communications Inc., *Smithtown, New York* 11787 (DF096660; F33615-74-C-1036)

To expand the present 94 gHz capability toward the evolution of a 94 gHz receiver system for radiometry, high-resolution radar, weapon delivery and REECE/ELINT requirements where improvements in PARAMP noise figure for the various applications remains a desired goal.

The approach will be to improve mixers and GaAs varactors for 94 gHz operation: 1) utilization of solid-state pump sources, (2) improvements in circuit designs and (3) the improvement in PARAMP noise figure.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHM Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0035, DETERMINATION OF CAVITY FIELDS EXCITED BY AN ELECTROMAGNETIC PULSE THROUGH AN APERTURE

D.K. CHENG, Syracuse University, School of Engineering, *Syracuse, New York* 13210 (DF043650; AF-AFOSR-3002-76)

AF function - the penetration problem of nuclear electromagnetic (EMP) energy into the interior of a cavity-like structure through an opening in the surface is of particular practical importance to the Air Force EMP assessment, testing and hardening programs for aircraft systems. Deficiency - considerable effort has been devoted to the investigation of electromagnetic coupling through cavity-backed apertures of various shapes and sizes. However, small apertures are usually assumed and the effect of cavity reflections on aperture field distribution is usually neglected. Objective - to develop suitable numerical solution procedures for cavity-backed aperture problems avoiding the quasi-static approximation and treating the internal and external portions of the problem simultaneously. Contribution - work will provide improved computational ability for aircraft assessment programs as well as representative calculations of the field at typical points inside a rectangular cavity when a transient electromagnetic plane wave is incident upon a slot aperture.

In previous work, the quasi-static approximation was avoided and the internal and external portions of the problem were solved simultaneously. The induction theorem was invoked in determining the scattered fields. New variables were introduced to change the governing second-order differential equation to a set of first-order equations which correspond to normalized state equations. The method of moments was used to convert the Laplace-transformed differential equations into a set of matrix equations. The primary goal of the current work will be to develop suitable numerical solution procedures for the matrix equations.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0036, INTEGRATED THERMOELECTRIC COOLER

J. HARPSTER, Ohio Semitronics Incorporated, *Columbus, Ohio* 43212 (DN590106; N00019-76-C-0258)

The objective of this program is to develop fabrication processes and techniques using state-of-the-art thin and thick film technology for the deposition of miniature thermoelectric devices and to study methods of packaging the thermoelectric and semiconductor devices which are consistent with volume manufacturing. These thermoelectric coolers would be used for temperature stability, temperature depression and removal of hot spots which affect surrounding temperature-sensitive components, such as FETS, Gunn devices, and injection lasers.

Develop substrate specifications and requirements for substrates fabricated out of Si, GaAs, BeO and Al2O3. Thermoelectric material composition will be defined and several thermoelectric-integrated circuit configurations will be fabricated for evaluation. Minimum temperature differential will be 30C. Recommendations will be made to achieve improved thermoelectric device operation and on the set-up and operation of a device compatible pilot production operation.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0037, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATIONS

R.T. COMPTON, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DN590096; N00019-76-C-0195)

The objective of this program is to develop adaptive antenna systems that are capable of automatically receiving desired signals from all angles while providing interference suppression and antijam protection in airborne military communication systems.

Primary emphasis will be placed on investigating adaptive antenna concepts appropriate for multiple access systems. Problem areas to be addressed include broadband signals, convergence rates, and the effects of mutual coupling.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0038, EVALUATION OF NOZZLE CONCEPTS TO INCREASE JET ENTRAINMENT FOR EJECTOR AUGMENTORS

F. BELLAR, Rockwell International Corp., *Columbus, Ohio* 43216 (DN590124; N00019-76-C-0335)

To test concepts for increasing jet entrainment for ejector augmentors.

A swirl nozzle configuration will be tested respecting its efficiency in increasing jet entrainment in ejector-type thrust augmentors.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0039, AUXILIARY POWER UNIT (APU) LABORATORY

P.G. COLEGROVE, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458270)

To develop and operate an in-house capability to test either contractually developed APU components or develop new APU concepts, to provide quick reaction response to requests for technical assistance and problem solution from using Air Force organizations such as SPO's and other laboratories.

Build and maintain suitable laboratory facilities for conducting tests on APU components or concepts.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory POP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0040, LOW G LAUNCHING SYSTEM

W.E. PETRANSKY, Gulf & Western Ind. Prod. Co., *Swarthmore, Pennsylvania* 19081 (DF320530; F33615-75-C-0121)

To provide a reproducible method for obtaining a controlled velocity within plus or minus 3 percent for simulating crash environments based on the deceleration of test subjects and fixtures rather than the acceleration of subjects and fixtures.

A stored energy launching system will be developed, designed, built and tested by the contractor. This system will impart to the existing AMRL impact sled the required velocity using the existing track system. The device will provide a minimum of one second unpowered coast time prior to impacting a braking device at a maximum velocity of 125 feet per second. The minimum required impact velocity will be 10 feet per second.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0041, AVIONICS READINESS

G.L. AVERILL, U.S. Navy, Systems Analysis & Engr. Dept., *Warminster, Pennsylvania* 18974 (DN581352)

The primary goal of the avionics readiness effort is to establish the basis for cost-effective support of avionic systems which will be introduced into fleet service in the 1980-2000 year period. The effort will impact the development of avionics and their related support systems to the extent that skills and material required to support those systems can be predetermined, maintained, and bounded. Successful completion of this program should result in a practical design to cost or life cycle cost capability in avionic systems acquisition.

The technical approach recommended by this plan is one of systems design. All elements related to the readiness and support objective will be treated simultaneously, equally, and as interrelated elements with the objective of establishing cost-effective trade-offs.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0042, HYDRAULIC DIAGNOSTIC AND CONDITION MONITORING SYSTEM FOR MILITARY AIRCRAFT
D. BAGWELL, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN681074)

Develop a diagnostic and condition monitoring system for military aircraft hydraulic systems. To maintain the highest component and system reliability, survivability and safety standards, it will be necessary to determine the operational condition of component parts of the system at any given time period and remove them prior to catastrophic failure.

Conduct exploratory development on a system basis to determine the most effective method of measuring the operational status of components such as sensing devices with readout panels interfaced with computer systems for determination, acoustics, cyclic variation, stress level, torque loss, leakage, wear and other characteristic system and component properties. Interface with commercial airlines and other DoD installations for exploratory evaluation of existing methods of systems analysis.

ADDENDA: Supporting agency address is: Naval Air Systems Command Tech. Admin. (Equip. and Support), Washington DC

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0043, ROTATING ARM RAIN EROSION TESTS APPARATUS
G. TATNALL, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN781135)

Develop a Navy capability for research in the phenomenon of rain erosion damage and for qualification testing of materials and constructions in an erosion environment at subsonic and low supersonic velocities applicable to aircraft and missile systems.

The most cost-effective method for obtaining quantitative damage rate data is with the use of a rotating arm apparatus. Impact fracture velocity, erosion incubation times and erosion rate dependence upon rain intensity, velocity and impact angle can be established for predicting the life expectancy and repair level required for given radomes, metal coatings, elastomers, paint or metals.

ADDENDA: Supporting agency address is: Contraves Goerz Corp., Pittsburgh PA

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0044, FEEDBACK CONTROL LAWS FOR NONLINEAR SYSTEMS
A.E. PEARSON, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DF040420; AF-AFOSR-2793-75)

Air Force function - over the past decade Air Force superiority aircraft performance has depended heavily upon air-to-air missiles. Deficiency - missile performance in sea demonstrated that this dependence is unjustified, and a principal reason for this is the inadequacy of the missile guidance system. Objective - the objective of this research is to develop analytical methods for controlling nonlinear systems. How work contributes - success in developing such methods could enable the implementation of improved guidance schemes for air-to-air missiles.

Two specific approaches will be investigated - the formulation of feedback control laws for nonlinear systems and the development of methods for implementing gradient-based parameter adaptive control algorithms for nonlinear plants with slowly varying unknown parameters. The feedback control work centers about a minimum energy-average power constraint approach developed by the principal investigator, and seeks feedback control laws based upon approximate state space characterizations. The adaptive control work will be an extension to nonlinear systems of a gradient-type algorithm for parameter adaptive control.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0045, TRANSIENT HIGH-PRESSURE LIQUID RHEOLOGY
A. CAMERON, Imperial Coll. of Sci. & Tech., *London, England Sw7, United Kingdom* (DN575192; N00014-76-G-0019)

The objective of this work is to determine the influence of molecular structure on the time-dependent viscosity and density response of liquids and other viscoelastic materials. This data is needed in the design and development of rolling element bearing and gears for high- load - high-speed applications in equipment such as gas and helicopter transmissions.

The approach will be to measure the densities and viscosities of the subject lubricants as a function of time at pressures up to 500,000 psi using a newly developed micro high pressure optical viscometer and to correlate these properties with theories of solid and liquid material rheology.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0046, LASER PASSIVE COUNTERMEASURES CONCEPTS
R. BLAISDELL, Boeing Company, *Seattle, Washington* 98108 (DA0D4055; DAAJ02-76-C-0017)

Investigate AH-1G high-energy laser vulnerability and countermeasures concepts.

Establish AH-1G baseline high-energy laser vulnerability by analysis supplemented with test data, where available. This will be the evaluation of the reduction in high-energy laser vulnerability after various countermeasures are applied. Impact on aircraft performance, mission accomplishment, cost, etc., will be evaluated.

ADDENDA: Supporting agency address is: AVSCOM Eustis Directorate, Air Mobility R&D Laboratory, Ft. Eustis VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

4.0047, FLUID MECHANICAL REFRACTING GAS PRISM APPLICABLE TO LASER TECHNOLOGY
W.H. CHRISTIANSEN, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (DF026720; AF-AFOSR-2650-74)

AF function - weaponry. Opportunity - underlying the successful application of lasers to a host of Air Force purposes from high-energy radiant energy projection to optical ranging is the provision of adequate power to the light-producing unit. This power is obtained through time compression of stored energy. Fluid mechanics appears as an alternative way to provide the physical basis for developing the needed technology to deflect light and/or store light so that it can be released rapidly in an analogous way to the electrical capacitator. Objective - to both theoretically and experimentally study aspects of fluid mechanical optics that might lead to new optical systems useful for laser technology. The fluid mechanical optics program has been expanded to include more than the light capacitor (which is the primary object of the present work) since this program is fundamentally an investigation of all the aspects of fluid mechanics and their application to optics. How work contributes - the small losses associated with refraction of light in gases suggest the possibility of efficiently manipulating laser beams by gaseous media of continuously varying refractive index. The proposed research provides insight into basic mechanisms of gas prisms which could be used to either deflect very intense laser beams, as a light storage device or delay unit, or as a tool which could be useful in the study of very low gain gaseous laser media.

Measurements of laser beam quality and losses after refraction by the gas prism are to continue as a function of nozzle characteristics as well as the position and angle of the laser beam. Also during this proposed support period an attempt will be made to construct and investigate the characteristics of a small 360 degree device which will provide a closed trajectory for the trapped light.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, NAVY ENVIRONMENT - STRATOSPHERIC ION SPECIES

L.B. LOEB, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (DN475006; N00014-75-C-0412)

The object of this work is to complete some research on the diurnal effect of engine emissions, especially particulates, hydrocarbons, nitrogen oxides among the exhaust constituents on the natural ionic species and balance of the upper atmosphere. This work started as part of the climatic impact assessment of high-performance aircraft on the stratosphere. The reporting to be completed under this extension will be useful to the military in connection with impact statements on introduction of new aircraft.

Data accumulated in the climatic impact assessment program (CIAP) of DoT will be used in completing this work. This accumulation includes data on chemical rate reactions and the temperature coefficients of those reactions, and also some data (not enough) on the concentrations of the various ionic species and their mobilities. The essential end product of the research will be graphs of the diurnal variation of ionic specie concentration and mobility. The mobility data is important because a shift in the mobility spectra is a sensitive indicator of pollution.

ADDENDA: Supporting agency address is: Office of Naval Research 465, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0002, ELF FADING STUDY

W.L. IMHOF, Lockheed Missiles & Space Co., *Palo Alto, California* 94304 (DN575307; N00014-75-C-0954)

In Navy ELF radio propagation measurements, unexplained amplitude degradation has occurred frequently. It is postulated that ENE electron precipitation into the lower d-region ionsphere is the source of the amplitude degradation. The verification of this postulate is important in the design and sizing of the sanguine ELF FBM communication system.

Electron precipitation data taken by one previous and one currently operating ONR ionospheric research satellite will be analyzed to determine the correlation of the ELF fading with electron precipitation along the propagation path. These results will then be used to predict the magnitude of fading due to PCA events and other high-energy electron precipitation events, thus allowing a design margin to be built into the sanguine system.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0003, NORTH PACIFIC EXPERIMENT (NORPAX) - REMOTE SOUNDING OF TEMPERATURE OF OCEAN SURFACE IN CLOUDY ATMOSPHERES

M.T. CHAHINE, U.S. Natl. Aero. & Space Adm., Jet Propulsion Laboratory, *Pasadena, California* 91109 (OCE76-81141)

The work described in the project summary for OCE7413738 has been successfully completed. This action provides an additional 12 months support to (1) determine the accuracy of sea surface temperature and cloud heights and amounts which are obtained from current NASA and NOAA satellite-based atmospheric sounders in the North Pacific area, and to (2) define the NORPAX requirements for future satellite-based atmospheric sounders. This work is principally supported by NASA.

SUPPORTED BY U.S. Natl. Science Foundation

5.0004, REMOTE SENSING AND EVALUATION OF MARINE ENVIRONMENT AND MATERIALS

G.A. EDGERTON, U.S. Navy, Civil Engineering Lab., *Port Hueneme, California* 93041 (DN687120)

To develop a technique to allow the in-situ continuous monitoring of marine materials. This method will allow continuous monitoring of such things as leaching rates of underwater antifouling materials, decomposition of paint matrix, fouling rates on submerged surfaces, fouling or scale build-up on inaccessible surfaces, determining corrosion rates, etc. The method can be used for any material which will deposit or adhere to a quartz surface.

The basic principle is to use a piezoelectric driving system for converting electrical vibrations into the corresponding mechanical vibrations. A piezoelectric driving system is a driving system in which the mechanical forces result from the deformation of a crystal having piezoelectric properties. Presently, visual inspections allow the simultaneous effects of fouling and corrosion (leaching, etc.) of test specimens to be described. However, these parameters can also be determined by the effect each produces on its mechanical system when its response to vibration excitation is measured. The essential mechanical parameters are (1) mass, (2) mechanical resistance, and (3) compliance. These mechanical descriptors have electrical counterparts, (1) inductance, (2) electrical resistance, and (3) capacitance, which can be measured in situ and equated with the mechanical parameters. By measuring the electrical impedance of the driving system, we can determine the mechanical properties of the system--mass/mechanical resistance/compliance.

ADDENDA: Supporting agency address is: Civil Engineering Laboratory Naval Construction Battalion (l03) Center, Port Hueneme, CA 93043

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0005, NAVY ENVIRONMENT

T.P. BARNETT, Univ. of California, Scripps Inst. of Oceanography, *San Diego, California* 92038 (DN223748; N00014-75-C-0260)

Variability, both short-term and long-term, in the temperature structure of the upper ocean has a pronounced effect oN acoustic propagation conditions and hence on ASW operations. The objective of this project is to provide a better understanding of the structure and evolution in time of the sea surface temperature field and of the temperature structure of the mixed layer. This project is an integral part of the North Pacific Experiment (NORPAX).

Naval P-3 aircraft will be utilized in support of NORPAX field programs for purposes of ocean monitoring, primarily the upper-ocean thermal structure using calibrated Navy AXBT's ((SSQ-36) sonobuoys), and secondarily sea surface temperature patterns using infrared sensors as well as surface currents using aircraft-tracked drifting buoys.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0006, SURVEILLANCE - AMBIENT NOISE AND PROPAGATION MEASUREMENTS IN CENTRAL ARCTIC PACK

B.M. BUCK, Polar Research Laboratory Inc., *Santa Barbara, California* 93101 (DN475176; N00014-74-C-0065)

The objective of this program is to collect via arctic data buoys ambient noise and transmission loss data in the arctic. The data will be relayed to shore stations via NIMBUS F satellite, and will lead to an understanding of ambient noise and propagation characteristics in the arctic.

Remote measurements of ambient noise and propagation data will be taken with an array of data buoys placed in areas of desired measurements. Propagation will be measured using explosives, probably MK 61S and MK 61-MK 14S detonated at 60 and 800 feet, respectively. Measurements taken by these remote buoys will be transmitted via NIMBUS F satellite to a collection point at Fairbanks, Alaska.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0007, NAVY ENVIRONMENT - AIR-SEA FLUXES NEAR THE OCEAN SURFACE

R.W. BURLING, Univ. of British Columbia, Inst. of Oceanography, *Vancouver 8, British Columbia, Canada* (DN624127; N00014-76-C-0446)

The Navy has a need for an improved capability to predict characteristics of the environment near the air-sea interface. These characteristics include (1) the lower atmospheric boundary layer needed for forecasting radar propagation, (2) upper ocean drift currents needed for optimum-track ship routing, and (3) the upper-ocean mixed layer needed for surface-duct acoustic propagation. The objective of this task is to improve our understanding of how the atmosphere and ocean interact and influence each other.

Instrumentation is developed to monitor velocity, temperature, and moisture fluxes across the sea surface, especially under conditions of high winds (greater than 15 mph) when most flux occurs. Techniques are evaluated for both remote and long-term deployment of this instrumentation. Formulas relating these fluxes to mean wind, temperature, and humidity based on synoptic, seasonal, and climatic averages are sought.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0008, NAVY ENVIRONMENT - SUBMARINE AND AIRCRAFT PROFILING OF ARCTIC SEA ICE

R.W. BURLING, Univ. of British Columbia, Inst. of Oceanography, *Vancouver 8, British Columbia, Canada* (DN675325; N00014-76-C-0660)

ASW/USW in the arctic require definition of the environment in order to operate. For example, acoustic propagation transmission loss has been found to be directly related to underice roughness. The scientific objectives are to determine the distribution of keel drafts to be expected given a known distribution of sail heights. The determination of a valid relationship between the two distributions will be of tremendous value in the prediction of safe depths for pipeline laying or submarine operations. The horizontal scales of upper and lower roughness can be compared in the same way and together the results will give fresh insight into problems such as the contribution of form drag at the ice-water interface to ice dynamics, the influence of ridges and hummocks on the heat balance of the arctic ocean and the mean growth rate of ice, the determination of the true mass transport involved in ice drifts such as the East Greenland Current, and the prediction of acoustic transmission loss under ice.

This proposal for Dr. Peter Wadhams at the University of British Columbia will address the above objectives through statistical analysis of bottom side ice profiles collected by the UK submarine H.M.S. Sovereign. Topside data will be collected by a coordinated overflight by the laser-equipped Canadian Argus plane and will be collected with the submarine data.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0009, PREDICTABILITY OF WINDS IN THE LOWER ATMOSPHERE

J.E. CERMAK, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80521 (DN923013; N00014-68-A-0493-0001)

The objectives of this research program are to develop a body of fundamental knowledge on shear flows with complex boundary conditions and to establish similarity criteria by which the laboratory-generated shear flows can be related to corresponding wind flows in the lower layer of the atmosphere. The result of this research will bear directly on a variety of problems of current naval interest, e.g., the diffusion rates of radioactive, chemical, and biological agents, the dispersion of low-flight-path missiles, local weather modification, short-wavelength, electromagnetic transmission, and VTOL and STOL aircraft operations.

A closely coordinated program of experimental, analytical, and numerical investigations will be conducted to determine the effect of various perturbations on an on-coming, two-dimensional shear flow. In particular, the effects of non-uniform surface temperature, mountain- like surface irregularities, and momentum addition by localized jets will be examined. In all the investigations similarity between flows of different length scales will be sought in order to make application of the laboratory data to the atmosphere.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0010, STRATOSPHERE ANALYSIS FOR NAVAL WEATHER OPERATIONS

F. FINGER, U.S. Dept. of Commerce, Natl. Oceanic & Atmos. Admin., *Washington, District of Columbia* 20235 (DN531445; N00019-76-IP-69002)

To aid in maintaining a consistent observational system for the upper atmosphere, by establishing adjustment techniques for new data systems designed to make them compatible with the others in current use. To develop and improve methods for objective analysis of stratosphere data in support of numerical modeling efforts.

Use of statistical analysis in determining the compatibility of various kinds of stratospheric data. Use of successive-approximation method for objective analysis of synoptic data. Specifically, (1) use objective-analysis techniques appropriate to changing circumstances, (2) for satellite overpasses nearly coinciding with radiosonde/rocketsonde launches compare radiances calculated from the latter with satellite- observed radiances, (3) compare satellite-derived temperature profiles with radiosonde-rocketsonde profiles, (4) apply satellite radiation data to the problems of stratospheric analysis, (5) determine impact of satellite data on calculations of atmospheric energy.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept of Defense - Navy

5.0011, ENVIRONMENT SUPPORT TECHNOLOGY - RESEARCH ON ATMOSPHERIC DYNAMICS & NUMERICAL WEATHER PREDICTIONS FOR NAVY OPERATIONS

H.J. MASTENBROOK, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN520028)

Improve the Navy capability for numerical weather prediction by determining the distribution of atmospheric constituents which affect atmospheric density and the radiative budget. Provide reference measurements for the assessment of climatic impact of Navy aircraft and missile systems which pollute the stratosphere.

Balloon-borne and aircraft instrument systems are used to measure vertical and horizontal distributions of atmospheric trace constituents over an extended time period for time and space variability and causal relationships.

ADDENDA: Supporting agency address is: Naval Research Laboratory (80009, Washington, DC 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0012, NAVY ENVIRONMENT - CLOUD ECHOES AND SFERICS

H. HISER, Univ. of Miami, School of Marine & Atm. Sci., *Miami, Florida* 33124 (DN624020; N00014-75-C-0172)

The aim of this research is to improve weather forecasting ability for storm activity on the mesoscale (about 1000 km) using standard meteorological data plus the tools of radar and sferics.

To obtain comparisons between synoptic conditions on storm and no storm days, a block of June through September data will be used for the triangular area formed by Miami, Tampa, and the Kennedy AF Station, Florida. The air mass convergence and moisture flux for this area will be computed at seven different levels from the daily radiosondes. Intensity and extent of storm activity in the triangle will be determined from sferics, radar, and satellite data.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0013, ANALYSIS OF OZONE MEASUREMENTS
R.A. CRAIG, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (ATM76-00557)

This research will emphasize a study of the vertical ozone distribution and methods of determining it.

The study will analyze and compare published or otherwise available ozone measurements of different types with the following principal objectives:

(1) To define the patterns of variability in vertical ozone distributions as a function of season and location, (2) To define the patterns of variability in Umkehr observations as a function of season and location, (3) To determine to what extent and in what manner the latter are related to the former, (4) To determine the possible utility of surface infrared observations in supplementing Umkehr measurements for the inference of vertical distributions.

SUPPORTED BY U.S. Natl. Science Foundation

5.0014, INVERSE PROBLEMS IN SCATTERING AND GEOPHYSICS
V. BARCILON, Univ. of Chicago, School of Humanities, *Chicago, Illinois* 60637 (DN575174; N00014-76-C-0034)

Inverse problems arise in problems in which information is desired about a scattering obstacle, a source distribution or an inhomogeneity of a medium from remotely sensed data. Naval applications include reconstruction of a scattering obstacle (ship, aircraft, missile), with sufficient accuracy for classification and identification purposes, reconstruction of soundspeed profiles in the ocean, design of antennas from the desired farfield pattern and idenification of location and size and shape of objects burried in the earth or submerged in the water. The objective of this task is to develop mathematical methods for treating inverse problems.

Numerical and analytic techniques will be developed to treat inverse eigenvalue problems. Applications considered will be primarily from geophysics and inverse scattering.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0015, EXPLORATORY DEVELOPMENT PROGRAM TO DEVELOP BROADBAND MICROWAVE ABSORBER MATERIALS
I. KOFSKY, Univ. Inst. For Navy, *Naples, Italy* 80100 (DF243300; F19628-75-C-0126)

AF function - low-altitude operational satellites and ballistic nuclear weapon delivery. Deficiency - trajectory of missiles and satellites cannot be precisely calculated. Research - utilization of measured turbulent transport parameters in model atmospheres. How research contributes - permits more accurate calculations of dynamic model atmospheres. The results can be used to predict missile reentry and satellite orbit calculations. Abstract - the objective of this work is to measure the turbulent diffusion coefficients and heating rates of the upper atmosphere and incorporate them into model atmospheric calculations.

The molecular and turbulent diffusion coefficients and turbulent heating rates will be determined from the measurement of the fluctuations of tracer density observed in rocketborne chemical trails in the stratosphere mesosphere and lower thermosphere. These measured vertical coefficients will then be incorporated into one-dimensional atmospheric models and the resultant species distributions compared to existing measurements.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK Wright Patterson AFB, Ohio 45433. Performing organization: Istituto Universitario Navale, Naples.

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0016, NAVY ENVIRONMENT - COASTAL CIRCULATION PATTERNS FROM SATELLITE IMAGERY
L. ROUSE, Louisiana State Univ. Systems, Coastal Studies Institute, *Baton Rouge, Louisiana* 70803 (DN575160; N00014-75-C-0192)

This research will be directed toward an investigation into the use of satellite visual and thermal data to track water masses and surface water motion in a coastal region. Knowledge of surface current fields and water mass characteristics is essential information for a variety of Navy and Marine Corps operations, including amphibious, swimmer and diver and shallow and deep water ASW.

DMSP visual imagery will be used to detect the turbidity patterns in the Louisiana bight, with DMSP thermal imagery being used to differentiate riverine and Gulf of Mexico waters. An image analysis system of CSI will be used to delineate different water masses and trace the general circulation pattern. Higher resolution ERTS-1 imagery, which is obtained less frequently, will be correlated with the water masses detected on the DMSP imagery. During the period of data collection, several transects of the area will be made to collect water samples and make surface water temperature measurements. Wind, tide, and river discharge will also be monitored for correlations with the observed current patterns.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0017, ATMOSPHERIC INFLUENCES ON ECOSYSTEMS AND SATELLITE SENSING
G.R. COOPER, Univ. of Maine, Agric. Experiment Station, *Orono, Maine* 04473 (0060395; ME08009)

OBJECTIVE: Develop methods for evaluation and utilization of remotely sensed data pertaining to agricultural ecosystems from ERTS and aircraft. Evaluate environmental effects by use of a chemical reaction temperature integrator and an inter-regional phenological network.

APPROACH: A photographic analysis of ground cover utilizing ground truth stations for verification of the data. Both aircraft and satellite photographs will be used. Chemical reaction integrators plus living plants as phenological tools will be used to follow the course of annual and long-term climatological effects on plant growth.

PROGRESS: Progress in the remote sensing of soil types in inaccessible wooded areas by G.R. Cooper in cooperation with the Soil Conservation Service has been quite successful. One-season trials on a test site with excellent ground truth data have given an accuracy of approximately 90 percent.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0018, NAVY ENVIRONMENT - UNDER-ICE ROUGHNESS
L.A. LESCHACK, Development & Reso. Trans. Co., *Silver Spring, Maryland* 20902 (DN675351; N00014-76-C-0757)

The objectives of the proposed work are: (a) to evaluate the geographical and temporal variability of the under-ice roughness parameters in the Arctic Ocean; (b) to determine if the roughness parameters seem to remain relatively constant with respect to one another for different geographical areas from year to year, thence to determine whether this geographical variability can be well correlated with ridging intensity measurements derived from airborne data; (c) to determine whether under-ice roughness parameters can be estimated from NOAA VHRR satellite data; and (d) to provide guidance for establishing locations for further long-distance sound propagation experiments in the Arctic Ocean.

Digitize submarine under-ice profiles taken between 1960-62 and compute roughness parameters, primarily ice depth and linear frequency of keels. These parameters will be examined for geographical and temporal variability to determine quantitatively whether roughness variations can be grouped geographically.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0019, INFERENCES OF F-REGION ELECTRON DENSITY FROM OPTICAL LIMB SCANNING
R.A. VANTASSEL, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF247860)

AF function - the Defense Meteorological Satellite System (DMSS) has a requirement from the Joint Chiefs of Staff to provide worldowide electron density reports and forecasts. Deficiency or opportunity - this effort is to investigate the feasibility of inferring electron density in the f-region by measuring ultraviolet airglow emission which is excited by electron impact and electron recombination. It takes advantage of the opportunity of using a limb scanning ultraviolet spectrometer which will be flown on the meteorological satellite for another mission. Objective - to determine the functional relationships between ultraviolet airglow and electron density, neutral density, temperature and solar activity. How research contributes - by comparing data from the meteorological satellite with computational models, we will assess the accuracy of inferring electron density parameters from ultraviolet airglow data. We expect improved electron density knowledge to enable more accurate forecasts of world-wide electron density.

The expected fourth-power correlation between the critical frequency and the intensity of radiation at 135.6nm produced by radiative recombination of electrons and atomic oxygen ions has been observed in the tropical nightglow by photometers on OGO-4. During the day an additional mechanism predominates in the production of 135.6nm radiation, that is, photoelectron impact excitation. The relative contribution of these two mechanisms will be assessed theoretically by using both a detailed model in which photoelectron fluxes are computed by a Boltzmann - Fokker - Planck kinetic model as well as a simpler empirical model. An airglow model will be developed which can then be fit to a scheme for determining model parameters from airglow data.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK L.G. Hanscom AFB, Bedford, MA 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0020, NAVY ENVIRONMENT - SPACECRAFT OCEANOGRAPHIC REMOTE SENSING

E.L. MOLLOCHRISTENSE, Mass. Inst. of Technology, School of Science, *Cambridge*, *Massachusetts* 02139 (DN675201; N00014-75-C-0291)

An improved knowledge of the capabilities of spacecraft for remote sensing of the oceans is required if we are to fully utilize these systems for surveillance, as well as non-acoustic and acoustic ASW purposes. The objective of this task is to assess how well passive spacecraft remote sensing techniques can be used to map oceanic features such as fronts, surface expressions of internal tides, and current systems.

The contractor will work, for example, with the Spacecraft Science and Engineering Center at the U. of Wisconsin to look over the extent of archived data; he will work with our contractors at Scripps and the U. of Miami in defining what ground truth experiments will be needed to identify the features noted in the archived data; and he then will suggest how remote sensing techniques might best be used for oceanographic monitoring purposes.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0021, NAVY ENVIRONMENT - AXBT DEVELOPMENT

R. BIXBY, Sippican Corporation, *Marion*, *Massachusetts* 02738 (DN675152; N00014-76-C-0230)

In order for the Navy to improve its capability to forecast the propagation of sound through the ocean for ASW purposes, it is necessary to improve our understanding of the variability of the thermal structure (upon which sound propagation is dependent) of the upper ocean. The objective of this task (Polymode Surveying, CNO Proj. No. R/S-12) is to develop an improved airborne expendable bathythermograph (AXBT) so that the Navy's capability to map the thermal structure from aircraft can be significantly improved.

This task will first determine the feasibility of coupling the sippican T-7 ship XBT with the existing technology for deploying expendable instruments (such as sonobuoys) from aircraft. The T-7 XBT has been extensively used by the oceanographic community, and it has the capability of accurately mapping the thermal fluctuations associated with the mixed layer and mesoscale eddies to a depth of 750 m. If the concept appears feasible, a limited number of AXBT's will be produced and evaluated in concert with a major oceanographic exercise.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0022, AIRBORNE MARINE FOG STUDY

R. MARKSON, Airborne Research Associates, *Weston*, *Massachusetts* 02193 (DN590178; N00019-76-C-0588)

To study micrometeorological processes associated with the life cycle of marine fog. The knowledge and insights acquired will be applied to the development of improved fog forecasting and fog dissipation techniques.

A specially instrumented small aircraft will be used to make observations in and above ocean fog in coordination with the R/V Acania. From these observations convective movement in the ocean boundary layer will be derived for correlation with other fog phenomena.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0023, NAVY ENVIRONMENT - SYNTHETIC APERTURE RADAR SENSING OF THE OCEAN SURFACE

R.A. SHUCHMAN, Environmental Res. Inst. Mich., *Ann Arbor*, *Michigan* 48107 (DN675694; N00014-76-C-1048)

All-weather remote assessment of coastal wave-spectra is desirable for a variety of Naval and Marine Corps operations; it may also provide clues on underwater topography. Only the synthetic aperture radar offers sufficient resolution for this task. Theoretically, it is not known how this will work because the target moves but it has been shown that in many cases useful results can be obtained.

Contractor will apply six optical methods of identifying or enhancing wave patterns in order to determine if anyone of them will lead to a better understanding and explanation of the observed results in order to establish reliability, accuracy and limitations of the method.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0024, NAVY ENVIRONMENT - CLOUD PROCESS MONITORING

G.D. FREIER, Univ. of Minnesota, School of Liberal Arts, *Minneapolis*, *Minnesota* 55455 (DN923095; N00014-75-C-0193)

On the assumption that electrical parameters in a cloud are developed in the same interaction kernel as are the precipitation processes, the objective of this research is to demonstrate that the electrical parameters can be used to monitor and follow the progress of cloud processes toward the precipitation phase of the cloud. This work will provide the Naval meteorologist with additional tools for observing and forecasting cloud conditions that lead to precipitation and lowered visibilities, both of which conditions affect numerous naval operations.

Two types of cloud conditions will be monitored for precipitation development and build-up of electrical field, unseeded and seeded clouds. If it can be demonstrated that the various cloud phases can be followed electrically that lead to precipitation (by both ground and aircraft measurements of electric field and ground radar measurements of cloud precipitation) then a technique will be available not only for selecting seedable clouds but also for monitoring the effect of seeding once a cloud is seeded.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0025, NAVY ENVIRONMENT - STRATOSPHERIC NUCLEI

J. PODZIMEK, Univ. of Missouri, Space Sciences Research Center, *Rolla*, *Missouri* 65401 (DN575313; N00014-75-C-0413)

Calibration of and application of an Aitken nuclei (AN) counter to observations of the stratospheric aerosol count is the objective of this research. Naval relevance stems from the usefulness of this information in assessing solar terrestrial reaction for development of a longer range meteorological forecast for strategic planning and additionally for assessing the climatic effect of high-performance aircraft on the stratosphere.

The absolute Aitken nuclei counter at the University of Missouri at Rolla (UMR) will be used to size the content of the large (UMR) aerosol reservoirs. This source will be used before and after flights of a GE Aitken nuclei counter to calibrate the counter.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0026, NAVY ENVIRONMENT - ANALYSIS AND MODELING OF SEA ICE CHARACTERISTICS IN THE ARCTIC USING SATELLITE IMAGERY

W.D. HIBLER, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (DN675489; N00014-76-MP-60012)

To develop analytic techniques of remotely sensed data which are complementary to predictive modeling and the models and to increase knowledge of the environmental factors affecting the motions and state of sea ice. Prediction of the environment for the benefit of surface and undersea operations is a goal of the Arctic program.

The contractor will obtain ERTS, NOAA-2 and ESMR data from satellites which are analyzed to obtain relative and absolute velocity vectors of identified ice features. Strains and strain rates are calculated. The sequential changes of lead patterns are studied in relationship to the changes in the atmospheric pressure field. The position of the ice edge is related to wind drift and energy exchange with the atmosphere. Ice compactness measured from imagery is compared to observer reports. The drift and deformation ice in the shear zone is studied to establish limits on zone width which to date are speculative. Shape change of floes during the melt season also provide information on deformation.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0027, THE IMS AURORAL ZONE EAST-WEST MAGNETOMETER CHAIN AND RELATED DATA ANALYSIS

J.S. KIM, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (ATM76-15612)

The International Magnetospheric Study (IMS) North American magnetometer networks at high latitudes consist of three meridional chains and an east-west chain along the auroral zone. This grant will establish and operate three magnetometer stations in the east-west chain. Together with stations operated by the Canadian Department of Energy, Mines, and Resources, the University of Alberta, the University of Alaska, and the U.S. Geological Survey, the east-west chain extends from 260 degrees E to 350 degrees E geomagnetic longitude. The magnetometer data from the east-west chain and other IMS chains will permit the study of the distribution, continuity, and temporal changes of the auroral electrojets and of other nonelectrojet currents, and magnetic pulsations of various categories. Other correlative studies will be performed in collaboration with investigators who will obtain data from satellites, sounding rockets, balloons, and ground-based observations.

SUPPORTED BY U.S. Natl. Science Foundation

5.0028, IN-HOUSE AMOS SUPPORT

D.W. HANSON, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13442 (DF707210)

The objective of this effort is to completely characterize atmospheric parameters which effect optical propagation at the Arpa Maui Optical Station (AMOS).

Atmospheric effects on optical propagation can be classed as either intensity or phase distortions. Molecular absorbtion and scattering, fog, clouds, etc., are examples of atmospheric effects which change the average intensity of an optical signal, although phase distortion is also associated with some of these phenomena. Temperature turbulence, i.e., small changes in temperature over short distances, is the predominant factor in causing optical beam phase distortion. Phase distortions will create fluctuations in the temporal and spatial intensity function of an optical signal, but the average intensity of the signal will not be affected. The atmospheric parameters which affect average optical signal intensity will be measured separately from those which affect the optical signal phase. Average intensity effects will be characterized by developing probabilities for a clear line of sight (CLOS) for various azimuth and zenith angles vs. the time of day and time of year. A contractual effort with Avco Everett Research Labs (AERL), J.O. 26460306, C/N F30602-75-C-0235, will provide data on atmospheric attenuation at infrared (ir) wavelengths. Phase effects will be characterized by measuring the temperature turbulence structure constant, and/or the optical propagation structure constant, versus altitude above AMOS. Such turbulence profiles will be measured at various times of the day and times of the year to determine their statistical behavior. From the profiles many optical propagation parameters can be calculated. The veracity of the profiles will be checked by measuring optical propagation parameters independently at the same time that the profiles are measured. The directly measured values will then be compared to the values calculated from the profiles. A contract with AERL, J.O. 26460115 C/N F30602-75-C-0012, provides for collection of data at AMOS and reduction of the collected data at either AMOS or Everett, MA.

ADDENDA: Supporting agency address is: Rome Air Development Center, Griffiss AFB, NY.

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0029, ATMOSPHERIC INFLUENCES ON ECOSYSTEMS AND SATELLITE SENSING (PHENOLOGY)

G.R. NOGGLE, Univ. of North Carolina, Agric. Experiment Station, *Raleigh, North Carolina* 27600 (0059140; NC01969)

OBJECTIVE: Study the influence of climate on the growth and development of plants (native, horticultural, and agronomic) in North Carolina. The interactions of soil type, nutrition, and management practices with climate also will be studied.

APPROACH: Several horticultural cultivars (Persian lilac, Syringa persica; honeysuckle, Lonicera tatarica cv 'Arnold Red'; Lonicera KorolKowi cv 'Zabeli') will be established at N. C. Agricultural Research Stations. Other plants such as dogwood and red bud also will be planted, and a search will be made for other appropriate plants. Observations will be made on phenological events such as bud break, first leaf appearance, flowering, leaf coloration, and leaf drop. Weather data will be recorded throughout the growing season.

PROGRESS: The NC Phenology Network now has 20 stations where both Persian lilac and Zabelii honeysuckle are planted. During the Spring we were able to obtain dates for leaf emergence and flowering at 8 sites. We have identified an additional 10 locations where plants will be put out during the Winter. Lilac is a marginal grower in most of NC and we are testing several other woody shrubs for the Network. We cooperated with the Regional NE-69 project in getting ground photographs at Raleigh and Ashville to coordinate with the ERTS-1 satellite pictures. A series of 12 ground shots from 20 locations were taken at 6-day intervals during the Fall 1972 as the leaves of deciduous trees became senescent and again during the Spring 1973 as the deciduous trees resumed growth. Our ground shots included deciduous trees, pastures, orchards, winter wheat, sorghum, and soybeans.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0030, PHYSIOGRAPHIC CLASSIFICATION OF SOUTHERN PINE FOREST LANDS

T. SILKER, Okla. St. Univ., Agric. Experiment Station, *Stillwater, Oklahoma* 74075 (0060893; OKL01526)

OBJECTIVE: Organize physiographic land patterns into a system having significance and utility for resource managers. Develop a physiographic map of southern region using the new systems.

APPROACH: Current information on physiography, soils, and surface geology related to forest vegetation will be analyzed and coordinated. Localized information will be reorganized to form a unified regional system. Map development will be on a state basis, utilizing local authorities, aerial photography, and space imagery when appropriate.

PROGRESS: Geological-pedological-phytosociological relationships were extensively studied and related to geomorphic patterns in Oklahoma, Arkansas, Texas, Tennessee, Kentucky, Alabama, Georgia and Florida. This allowed accumulation of ground-truth information that may be related to project objectives and ERTS images. Two symposia on ERTS equipment and procedures were attended to become acquainted with remote sensing potential and project submittal requirements. Oklahoma State University staff secured resource material and arranged for and accompanied soil scientists of the USFS and SCS, and an OSU geologist on a 3-day field trip in 1973 with the project leader, Earl Hodgkins, of Auburn University. Relationships were studied in the Coastal Plain, Ouachita and Ozark Highlands of Oklahoma. Geology-soil-wildlife habitat conditions and data collected by Don Savage, OSU Zoology Department, were reviewed with him at the Cookson Hills Refuge. The Oklahoma representative participated in the 1974 Southern Forest Environment Research Council workshop to delineate geomorphic provinces in Oklahoma identified in satellite photos. Project director reports a mosaic map covering states of Alabama-Mississippi, scale 1:1,000,000, and legend covering geomorphic provinces interpreted from ERTS satellite photos is expected for release January, 1976.

SUPPORTED BY Oklahoma State Government - Oklahoma City

5.0031, PHYSIOGRAPHIC CLASSIFICATION OF SOUTHERN PINE FOREST LANDS

C.L. LANE, Clemson University, Agric. Experiment Station, *Clemson, South Carolina* 29631 (0060710; FR00010)

OBJECTIVE: Organize physiographic land patterns into a system having significance and utility for resource managers. Develop a physiographic map of southern region using the new system.

APPROACH: Current information on physiography, soils, and surface geology related to forest vegetation will be analyzed and coordinated. Localized information will be reorganized to form a unified regional system. Map development will be on a state basis, utilizing local authorities, aerial photography, and space imagery when appropriate.

PROGRESS: The South Carolina data have been collected and forwarded to Dr. Earl Hodgkins at Auburn University for incorporation into the final map.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0032, STUDIES OF CYCLONIC STORMS IN WASHINGTON STATE

P.V. HOBBS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (ATM74-14726 A03)

This resume will center around a field study designed to determine the role of ice in cloud and precipitation processes in cyclonic storms in the Pacific Northwest. Emphasis will be placed on obtaining detailed information on scales of motion and physical processes ranging from the microscale up to the synoptic, so that the role of ice can be studied in relation to larger scale dynamical processes. This will be accomplished through simultaneous airborne, radar, rawinsonde and ground observations.

All of the major facilities required for the study are available and are currently being used in studies of this kind under a one-year grant from NSF. They include a B-23 aircraft, which is well-instrumented for cloud physics research, a pulsed Doppler radar, and a digitized PPI radar. These specialized facilities are supplemented by rawinsondes and a network of high-resolution precipitation gauges.

The results obtained from the field study will form the basis for developing a numerical model to describe the air motions and microphysical processes which lead to precipitation in cyclonic storms.

SUPPORTED BY U.S. Natl. Science Foundation

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, HUMAN ENGINEERING EVALUATION OF ADVANCED DISPLAY TECHNOLOGY

J. HEARD, Hughes Aircraft Company, *Culver City, California* 90230 (DF317820; F33615-74-C-4083)

The objective of this effort is to assess the rapidly growing technology in advanced electro-optic (e/o) display systems so as to identify functional relationships between advanced display design parameters and available or inferable measures of human performance. Specifically, the effort will provide a technology assessment and a review of the relevant human performance research. This technology assessment and evaluation is essential to AMRL's capability to provide basic human engineering data, research, and guidance in support of present and future system development efforts utilizing advanced display techniques.

The approach will consist of an in-depth review and documentation of present and projected e/o display technology in terms of potential application to the design of future air and ground crew stations. Anticipated relationships between display parameters and dimensions of human performance will be provided. A review of the literature will be performed to compile and document relevant research and to identify avenues of research having the greatest anticipated payoff relative to display characteristics identified as most critical to the effective utilization and application of advanced display concepts.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0002, HUMAN HEAD AND NECK RESPONSE TO MULTI-AXIS ACCELERATIONS DURING MILITARY PARACHUTING

D.W. CALL, U.S. Navy, Natl. Parachute Test Range, *El Centro, California* 92243 (DN695430)

(a) To acquire multi-axis acceleration data from the head and first thoracic vertebra (t-1) from subjects performing military parachute jumps. (b) To determine the physiologic effects of these inertial forces. (c) To correlate these data with other studies of human responses to impact acceleration.

Naval test parachutist volunteers will be fitted with accelerometer mounts for the head and t-1. They will then wear these mounts with accelerometers while performing parachute jumps at the NATparachuteTESTRAN, El Centro, using current fleet parachutes. Inertial and physiologic data will be transmitted to a ground receiving station during the entire egress and recovery event by a jumper-borne 17-channel fm/fm telemetry system. Analog tapes of this data will be sent to NavAeroMedRschLab Det. New Orleans for computer-assisted automatic data reduction, processing and analysis by both organizations.

ADDENDA: Supporting agency address is: Bureau of Medicine and Surgery, Washington, DC 20372

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0003, ANTI-SUFFOCATION VALVE

A. VANHAASTERT, Sierra Engineering Company, *Sierra Madre, California* 91024 (DN781214; N62269-76-R-0214)

To develop an anti-suffocation valve for use integrally with the A- 13 oxygen mask, hose, and regulator. This valve will function only in egress situations and will be inoperative during normal in-flight conditions. It will protect the unconscious aircrew member against suffocation in the event the emergency oxygen system becomes depleted. This contract supports WU ZA501, AA 833233.

Proposals have been solicited from industry to develop an anti- suffocation valve that will integrate with the A-13 mask, hose, and regulator.

ADDENDA: Supporting agency address is: NADC Crew Systems Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0004, PERFORMANCE MEASUREMENT
D. VREULS, Canyon Research Group Inc., *Thousands Oaks, California* 91361 (DN494016; N61339-74-C-0063)

Training efficiency can be achieved through proper control of the training process. Such control requires performance information; hence, training efficiency depends upon effective performance measurement. This task will develop a comprehensive real-time measurement system for flight training.

In three steps, the measurement selection method will be developed and improved, the resultant measurement system will be implemented in real-time or near real-time in an automated training system and a test and evaluation of the implementation will be conducted.

ADDENDA: Supporting agency address is: Naval Training Equipment Center Human Factors Lab, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0005, LONGITUDINAL CARDIOVASCULAR FITNESS IN USAFA CADETS
W.R. COTE, U.S. Air Force, Frank J. Seiler Res. Lab., *Colorado Springs, Colorado* 80840 (DF281870)

To measure the longitudinal cardiovascular fitness of USAFA cadets. This is a small part of the research program supported by AFOSR/NL at UC Davis.

Cadets (40) from the class of 1979 will be tested for metabolic rate during July and August of 1975 with follow-on testing in May 7 . Initial testing will be accomplished by a team consisting of USAFA and UC Davis personnel. Follow-on testing will be the responsibility of USAFA personnel. Funded by AFOSR-PO-76-0003.

ADDENDA: Supporting agency address is: Frank J. Seiler Research Lab NC, USAF Academy, Colorado 80840

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0006, INSTRUCTIONAL SYSTEMS DEVELOPMENT
J.F. FUNARO, U.S. Navy, Human Factors Laboratory, *Orlando, Florida* 32813 (DN694005)

(1) Production of a comprehensive ISD document which incorporates detailed management and technical procedures and which can actually serve as an instructional design guide (in the form of job-performance aids) within the Navy. (2) Development of a set of personnel, time and cost factors which can be used in evaluating ISD or in detailed planning for ISD projects. (3) Accumulation of a body of data which supports or refutes the desirability of routinely employing the ISD approach in response to instructional design and development problems.

Maximum utilization will be made of 'lessons learned' from project 5753. A thorough review will be made of all known applications of the ISD approach to aircrew and maintenance training in aviation systems. The review will document the management, technical and econometric procedures employed as well as measures of cost effectiveness realized. The Navy aircraft weapon system development cycle will be reviewed in order to determine the utility of presently required documentation to ISD as well as to establish milestones and constraints for the application of ISD. A guideline for the implementation of the ISD approach in the development cycle of naval aircraft systems will be developed. Specifications, DID's and other documentation needed to define required contractor and in-house activities will be prepared. The approach developed will be compatible with present system development policies and will be coordinated with other personnel-oriented disciplines such as human factors engineering. In addition, methodologies and procedures for assessing and validating the effectiveness of ISD programs will be developed.

ADDENDA: Supporting agency address is: Naval Air Systems Command Research and Technology, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0007, PERFORMANCE LIMITS IMPOSED BY VESTIBULAR RESPONSES IN MOVING MILITARY SYSTEMS
F.E. GUEDRY, U.S. Navy, Aerospace Medical Res. Lab., *Pensacola, Florida* 32512 (DN740703)

To specify limiting conditions of vestibular responses on performance in moving military systems as influenced by individual differences, adaptive training, physiological state, and visual display characteristics.

Visual performance, information processing, oculomotor responses, autonomic responses and perceptual and psychomotor performance are measured during simple and complex combinations of angular and linear accelerations simulating elements of military motion environments. The effects of modifying factors such as lighting, display layout, fatigue, alcohol, practice on response systems integral to man's control of motion are evaluated with a view to operational relevance.

ADDENDA: Supporting agency address is: Naval Aerospace Medical Res. Lab, Pensacola, FL 32512

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0008, REFLECTION AND DIFFRACTION ASPECTS OF BIOLOGICAL MICROWAVE DOSIMETRY
V.R. RENO, U.S. Navy, Biomedical Division, *Pensacola, Florida* 32512 (DN677172)

Procedures are developed that will provide new insight into the energy absorbed from microwave fields by living systems. This information is necessary to a valid estimation of the effects of microwave energy on naval personnel.

Reflection and diffraction studies will be performed with the ultimate objective of estimating absorption of microwave energy from information contained in the spatial and amplitude distribution of energy in proximity to illuminated objects. Holographic procedures are among those that will be applied to data from field scans taken near animals and objects of different shape and composition. This is conceptually a new approach that may provide an improved, noninvasive method for estimating the absorption of microwave energy by living organisms. This new work unit continues research previously performed as part of project number MF51.524.015-0012BE7X.

ADDENDA: Supporting agency address is: Naval Aerospace Medical Research Lab, Pensacola, Fla. 32512

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0009, VISUAL DISPLAYS - APPLICATIONS OF VISUAL SCIENCE TO SYSTEM DESIGN
J.W. WULFECK, New Mexico State University, School of Arts & Sciences, *Las Cruces, New Mexico* 88001 (DN675597; N00014-76-C-0805)

Visual science enjoys the longest history and the most substantial data base of any area on which engineering psychology draws. Despite the overwhelming literature in basic and applied visual research, little of it deals with the way in which visual science data may be applied in man-machine system design and development. This effort organizes and presents the essential content and methods of visual science in the context of typical system development problems, thereby demonstrating how these data can be more effectively utilized.

Several illustrative system design problems are selected as case studies. They will be chosen from typical cases such as a navy CIC, aircraft cockpit instrumentation, sensor displays, air strike planning and underwater swimmer systems. The system development process is described in the form of dialogues which explicate the various trade- offs between engineering considerations, human performance capabilities and cost. Relevant visual science data are presented as appropriate, and procedures are described for using the data to help resolve design questions.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0010, AIRCRAFT PERSONNEL RESTRAINT SYSTEMS IMPACT DYNAMICS
J.W. BRINKLEY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320450)

Current military personnel restraint system specifications require tests to determine only ultimate static breaking strength of restraint webbing material to evaluate the adequacy of restraint

systems during impact. Since restraint materials are sensitive to strain rate and the dynamic response of the human body amplifies impact loads, existing static test requirements are inadequate to insure crew protection during emergency escape or aircraft crash. Recent AFSC IG findings cite unresolved technical controversy regarding the affect of webbing properties on crew protection. The objectives of this research are to (1) determine the influence of the mechanical properties of restraint systems during impact, (2) provide biodynamic data for restraint design and dynamic test criteria and (3) acquire data for a computer model of the human body and restraint components to predict crew responses to impact environments.

The kinematic and inertial responses of volunteer subjects will be measured in a series of minus g x impact tests with three acceleration levels and three restraint harnesses. Static and dynamic tests of the restraint webbing will determine their mechanical properties. The stiffness of the harnesses will vary from 500 to 12,000 lbs/in. Human kinetic and kinematic responses will be predicted using a mathematical analog, the articulated total body model.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0011, DEVELOPMENT OF COMPUTER SIMULATION MODELING TECHNIQUES FOR AIR FORCE SYSTEMS

D.J. SEIFERT, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF319300)

Operations research models of manned systems such as the B-1 do not currently reflect the manner in which crew actions affect mission outcomes. The objective here is to explore ways in which system models can explicitly incorporate representations of crew performance and team efforts so designers can better visualize the consequences of design- induced performance errors and evaluate the human factors aspects of their various design alternatives or change proposals.

Based on the SAINT (systems analyses of integrated networks of tasks) applications experience gained under task 689305 and feedback provided by other agencies using these modeling techniques for manned system studies, refinements and extensions are made to make the simulation tools easier to use and more efficient to run on a wide variety of computer facilities. The experience gained is documented to provide guidelines, modeling principles and procedural rules for those who wish to use these techniques in their own systems studies.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0012, PSYCHO-PHYSIOLOGICAL ASSESSMENT OF NAVAL AIRCREW PROTECTIVE EQUIPMENT DEVELOPMENT CRITERIA

M. PASSAGLIA, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN581100)

To establish optimal physiological and biomedical specifications and criteria for the design, development, and testing of protective aircrew equipment including escape systems, restraint systems, fixed seat systems, survival equipment, and personal protective equipment. Requirements for this work are stated in the FY1974 Naval Aviation Biomedicine/Human Effectiveness Technical Workshop Report.

A continuing review of all department developments in life support, protective, and survival equipment intended for use by naval aircrewmen is conducted for the purpose of identifying those requireing psychophysiological and biomedical inputs. Such inputs are provided in the form of specifications and criteria, establishment of test protocols and safety procedures, pre- and post-test examinations of subjects, monitoring of subjects during tests, and biomedical and performance evaluation of test results. Methods having the greatest accuracy and reliability are devised and/or procured in order to make required performance and biomedical measurements in a manner fully consistent with the comfort and safety of the subjects.

ADDENDA: Supporting agency address is: Commanding Officer Naval Medical Research Dvlpmnt (71), National Naval Medical Center, Bethesda, Maryland 20014

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0013, SYSTEMS APPROACH TO TRAINING (EA-6B)

J. HYMES, Courseware Incorporated, *Provo, Utah* 84601 (DN594014; N61339-75-C-0100)

Develop procedures/models which will permit the deliberate and orderly planning of specific aircraft instructional programs necessary to ensure that personnel acquire the knowledge, skills, attitudes and behaviors essential for successful job performance in a specified aircraft. The models will include selection of the appropriate analyses necessary for performance parameter development and specification of training/behavioral objectives and will provide a basis for the selection of instructional material, methods, media, and equipment necessary for the development of an optimal, cost-effective curriculum.

Existing SAT methodology will be used to produce lesson specifications, media selection and analysis for each of the weapon systems. The program efforts will be limited to operator and tactical positions of the EA6B, E2C, A6E weapons systems.

ADDENDA: Supporting agency address is: Naval Training Equipment Center Human Factors Lab, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, STUDIES OF STATISTICAL AND SYNTACTIC APPROACHES TO PATTERN RECOGNITION

K.S. FU, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DF038330; AF-AFOSR-2661-74)

AF function - command, control and communications. Deficiency - increasing automation of Air Force functions requires increased capability to manipulate and reduce large amounts of data. Objective - provide near-real-time automatic reduction of large amounts of data into simple outputs. How work contributes - pattern recognition techniques can compress large amounts of data into simplified outputs.

The research will include both non-parametric sequential techniques and linguistic syntactic techniques to understand how pattern recognition can best be applied to problems of reducing large amounts of data to simple outputs. The sequential techniques will be oriented at how to best organize data in secondary storage devices for optimal calculations. The linguistic approach will generalize contemporary theory to that case where the patterns are noisy, thus enhancing the analysis procedures. Applications of this work will also be applied to speech recognition problems.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0002, NUMERICAL SOLUTIONS OF THE NAVIER-STOKES EQUATIONS FOR COMPLEX CONFIGURATIONS

G. MORETTI, Polytechnic Inst. of New York, School of Engineering, *Farmingdale, New York* 11735 (DN524858; N00014-75-C-0511)

An accurate and detailed knowledge of the flow fields about naval aircraft and missiles is essential for the design of new and advanced systems. This theoretical investigation will develop and exploit new numerical procedures for solving the equations of motion to describe aerodynamic flows for all speed ranges with emphasis on transonic and supersonic speeds.

Numerical techniques for the solution of the equations of motion for continuum flow will be developed with particular emphasis on practical accuracy, resolution of detail in the flow field, and the efficiency of computing. Attention will be devoted to the calculation of combined viscous-inviscid flow fields about complex bodies at high Reynolds numbers. The approach will utilize the Euler equations and the boundary layer equations in a

unified fashion so that both flows will be calculated in a single frame of reference. Initially two-dimensional and axially symmetric flows will be considered to develop procedures which can then be applied to an elliptic cross-section delta wing. Flows with and without separation will be treated.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0003, MATHEMATICAL PROBLEMS IN FLUID DYNAMICS

K.G. GUDERLEY, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136320)

Present design methods for aircraft and missiles have great difficulties to predict the behavior of airfoils in the transonic region. The work investigates theoretically problems of transonic aerodynamics. Sometimes special features, as the junction of sonic line and shock, are studied but most of the work is done with a view towards improving the methods for computing the whole flow pattern. The work includes the development of background knowledge, in particular, partial differential equations. The investigations are directed towards improving the numerical techniques, as well as the physical understanding of the phenomena in transonic flow fields. Spinoffs of similar numerical techniques to problems in stress and strain of aircraft structures will be explored.

The problem is treated under two different points of view, namely the study of properties of the partial differential equation and of its solutions which may be the cause of computational difficulties, and the direct study of numerical approaches. In the first part the nature of the solutions of typical boundary value problems will be investigated; in the second part a specific numerical technique will be examined with a view towards determining how well it or certain variants are suited to overcome the typical obstacles encountered in transonic flows. Another effort in aerodynamics is the computation of incompressible flow over multielement airfoils by means of an integral equation method (combined with preliminary conformal mappings). A related effort in this area is the proof of the adiabatic theorem for partial differential equations in two independent variables. Integral equation methods for the solution of the elastic problem in solid mechanics will be studied and then extended to elastic plastic problems.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBRD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0004, BASIC INFORMATION HANDLING METHODOLOGY

R. SANTMANN, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN833144)

The objectives of this effort are: (a) to develop a methodology for information processing and transfer in future Navy avionics, (b) to provide guidelines for the application of microprocessors, microcomputers, and computers in Navy avionics, and (c) establish a strategy for their procurement, standardization, logistic support, and maintenance in avionics configurations.

A functional analysis of future avionics systems is being done as part of NavAirSysCom's basic program. The results of that analysis will be used: (a) to develop requirements for avionic system/subsystem processing and interfacing, and (b) to determine the potential utility of microprocessors, microcomputers, and computers. An avionics system configuration trade-off will be done to determine the system configuration which results in the minimum cost of ownership. The trade- off will include the impact on ils, use of compatible (or standard) software, advanced and standard busses and interfaces, and implementation of future hardware in SEM (standard electronic modules). Likewise, software support guidelines will be developed oriented toward defining management tools to assure that computing elements in future systems will be software compatible.

ADDENDA: Supporting agency address is: Naval Air Systems Command (360B), Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, RESEARCH STUDY ON FIBER OPTICS FOR NAVAL APPLICATIONS

R.F. POTTER, Unknown Inst. or Indiv. Grant, *California* (DN590166; N00019-76-C-0461)

The contractor shall perform a research study of the state-of-the- art of technology for fiber optics for naval applications.

Special emphasis will be placed on those aspects of fiber optics technology which pertain to aircraft internal communications and to underwater cable applications.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0002, PLASMAS & THEIR INTERACTION WITH ELECTROMAGNETIC FIELDS FOR APPLICATION TO UPPER ATMOSPHERE WEAPONS EFFECT & COMMUNICATION SYSTEMS

B.D. FRIED, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DN524497; N00014-75-C-0476)

The objective is to carry out research on plasmas and their interaction with electromagnetic fields for application to ballistic missile effects, atomic weapons effects, electromagnetic communications, and energy conversion devices, used in naval operations. Ionization effects in plasmas as related to radio-frequency communication and telemetry from surveillance and navigation satellites, plasmas associated with ballistic missile signatures, ionospheric plasma disturbances used in high-altitude atomic weapons explosions detection, and the application of magnetic fields to plasmas as a means of directly converting the thermal energy of combustion to electrical power will be studied.

Work will consist of theoretical and numerical studies of nonlinear and collective phenomena in plasmas. Both wave-wave and wave-particle types of nonlinearity will be studied. Low-frequency drift wave instabilities will also be examined as they relate to diffusion in containment devices which have been stabilized against high-frequency instabilities. Plasma wave echoes will be studied to allow for their use as diagnostic techniques for particle distribution functions and collisions and diffusion processes.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0003, GROWTH OF GALLIUM ARSENIDE

W.P. ALLRED, Crystal Specialties Inc., *Monrovia, California* 91016 (DF246850; F19628-76-C-0118)

AF function - radar communications and ECM systems which require gallium arsenide microwave devices. Deficiency - gallium arsenide microwave devices lack reliability and reproducibility due in part to the poor quality of commercially available gallium arsenide substrates. Objective - to grow improved-quality gallium arsenide bulk crystals. How research contributes - this research should provide a technique to grow improved-quality gallium arsenide crystals for use as substrates for gallium arsenide microwave devices. It is expected that such devices will have higher reliability and reproducibility.

The approach to this work will be divided into three areas: 1) to construct a liquid-seal Czochralski crystal puller. 2) To use the crystal puller to grow high-quality single crystals of undoped gallium arsenide using various crucible materials which will include quartz, boron nitride, aluminum oxide, carbon, and aluminum nitride (if available). These crystals will be submitted to AFCRL/LQP for evaluation. 3) To grow single crystals of gallium arsenide which are intentionally doped with known impurities at known levels to produce n- type, p-type and semi-insulating electrical properties.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LQ Hanscom AFB, Bedford, MA 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0004, PHOTODETACHMENT STUDIES OF MOLECULAR NEGATIVE IONS 14118-P
W.C. LINEBERGER, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (DA0E9088; DAAG29 76 G0236)

To provide information required to predict the effect of light on a decaying atmospheric plasma. Negative ions play an important role in controlling the electrical conductivity in the atmosphere, and consequently the transmission of electromagnetic energy. This research is relevant to various Department of Defense efforts to model the atmospheric conductivity, for example, in connection with radar cross- section codes.

To utilize beam techniques to measure absolute photodetachment and photodissociation cross sections for NO sub 2, NO sub 3, CO sub 3, and CO sub 4 anions in the spectra region 3,400 - 2,800 angstroms. Fixed laser photoelectron spectrometry in the visible and near ultraviolet will also be utilized to determine binding energies and structures of atmospheric ions and cluster ions.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211 Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0005, PLASMA, ATOMIC AND MOLECULAR DATA FOR DESIGN OF LASER SYSTEMS
A.V. PHELPS, Univ. of Colorado, Joint Inst. For Lab. Astrophy., *Boulder, Colorado* 80302 (DN475350; N00014-76-C-0123)

The objective is to obtain plasma, atomic, and molecular physics data needed for the design and evaluation of laser systems for use in Navy weaponry and surveillance operations. Electron transport and excitation rate coefficient data will be determined for use in predicting the rates of electrical power input and production of excited species in electric discharges and electron-beam lasers and the design will be studied of lasers utilizing radiation associated with the lower excited states of metal vapors and rare gases.

Studies will be made of the stability of discharges in weakly ionized gases in order to quantitatively predict the growth of electrical instabilities and optical inhomogeneities which limit the useful quantities of electrical power which can be transferred to the gas molecules in a high-power laser. The buildup of negative ions from attachment and detachment, the effect of vibrational excitation and relaxation on the rise in kinetic temperature, and the rates of ionization and dissociation will be examined for an approach to local thermal equilibrium. Sets of electron transport coefficients, rate coefficient and collision cross-section data will be obtained for the development of accurate models of electrically excited gas lasers.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0006, STUDY OF VERY PURE METALS AT LOW TEMPERATURES
W.D. GREGORY, Georgetown University, School of Arts & Sciences, *Washington, District of Columbia* 20007 (E-(40-1)-3665)

SUMMARY OF PROPOSED WORK: During the next contract term, four areas will be investigated: inhomogeneities in equilibrium superconductors (normal metal inclusions), non-equilibrium superconductors, anisotropy in single-crystal superconductors and biological transformation in cryogenically preserved cells and bacteria exposed to large magnetic fields. In the studies of inhomogeneous equilibrium superconductors and non-equilibrium superconductors, the materials studied will be primarily thin films ranging from heavily oxygen-doped aluminum to best state-of-the-art indium and tin films. The inhomogeneous conduction in the equilibrium state can be produced and varied by increasing or decreasing the damage or dirtiness of the film by the rate of evaporation, presence of oxide, etc., during growth. These samples will be studied using d.c. resistivity, a.c. susceptibility, four-probe a.c. current-voltage measurements and in some cases, microwave and far-infrared transmission and absorption. We will also examine the effect of inhomogeneities in the counter electrode for SS tunnel junctions. There will be extensive theoretical treatment using the so-called 'effective medium approach' to describe the mixed condition. It is expected that the presence of the normal metal inclusions will be shown to produce many effects such as broadening of the superconducting transition, inaccurate energy gaps in tunnel junctions, the precusor effect in far-infrared and microwave absorption that have hitherto been unexplained. In the non-equilibrium condition, obtained by laser irradiation of the samples, similar experiments will be performed. We expect that the laser radiation will produce conditions where inhomogeneities are generated, both spatially and temporally, in much the fashion as is found in classical systems leading toward turbulence. The study of anisotropy in superconductors will be conducted with single-crystal samples, primarily those of gallium, and will extend the previous work where the energy gaps have been measured as a function of crystal orientation with a precision of 1 part in 10 to the third power via tunneling into bulk single crystals. Finally, the effect of large magnetic fields on cryogenically preserved cells was published by this group to appear in one of the November issues of Science. (Text Abridged.)

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0007, RADIATION VULNERABILITY AND HARDENING (POSITIVE IONS AND IMPLANTATION)
J.W. BUTLER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680021)

The objective of this work is to develop techniques, procedures, and methods that will lead to more radiation-resistant electronic components for Navy applications.

The technical approach of this work is to apply the techniques and instrumentation of nuclear physics research to the basic problems encountered in radiation hardening of electronic components. For example, the implantation of certain ions in metal oxide semiconductor devices has been found to make them more resistant to radiation damage than they would otherwise be. A 5-mv Van de Graaff accelerator and a 100-kv rf transformer accelerator provide a wide variety of ions for implantation. The location of these ions in the device is important in determining their radiation hardness, and under certain conditions implanted ions tend to migrate. Nuclear reaction techniques are used for acertaining depth concentration profiles of the implanted ions.

ADDENDA: Supporting agency address is: Naval Research Laboratory (6000), Washington, DC 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0008, CHARGED PARTICLE BEAM EFFECTS ON MATTER - THEORY OF PENETRATION BY HEAVY IONS
I. MANNING, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680007)

To develop improved quantitative understanding of the penetration of matter by energetic atoms or ions. The improvements comtemplated would have the following applications: (1) improvements in understanding and controlling ion implantation processes utilized in fabricating electronic and optical devices, including improved understanding and prediction of phenomena involved in range effects, atomic recoil effects and ion bombardment damage; (2) improvements in theories of sputtering, backscattering and other surface phenomena in ion bombardment; (3) improved theories for neutron irradiation damage to materials and devices; (4) improvements in the theory of the simulation of neutron damage by ion bombardment.

A transport theory approach, using a Boltzmann-type equation, is being applied. Numerical techniques using modern high-speed digital computers will be used to solve this equation. In addition, we are attempting to improve the existing theory of elastic atomic collisions at high energies.

ADDENDA: Supporting agency address is: Office of Naval Research (422), 800 Quincy Street, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0009, RADIATION-RESISTANT FIBER OPTICS
G.H. SIGEL, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680034)

The objective of this program is to prepare and characterize radiation-resistant optical glasses which are acceptable for fiber optic waveguides in military systems and to draw these materials into fiber form for testing and evaluation. The Navy needs the advantages of fiber optic transmission links, while maintaining survivability in tactical situations.

Fiber optic grade glasses will be prepared and radiation damage and protection mechanisms will be identified. Purification, selective doping, redox conditions and compositional variation will be employed to minimumize darkening under ionizing and particle irradiation. Promising materials will be drawn into fiber form. Emphasis is on achieving a radiation-resistant, medium-loss, high-numerical, aperture fiber for use in Navy avionic systems. Both the spectral and the temporal response of the fibers to irradiation will be determined.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0010, THE STUDY OF PHONONS AND ELECTRONIC PROCESSES IN ORDERED AND DISORDERED SOLIDS

S.A. SOLIN, Univ. of Chicago, James Franck Institute, *Chicago, Illinois* 60637 (E(11-1)-2126)

An effort will be made to observe irreversible and reversible photostructural and thermostructural transformations in evaporated bulk As2O3 glass. The optical effects associated with such transformations provide the capacity for high-density and rapid information storage. The detailed atomic configurations associated with the transformations will be studied using Raman, infrared, and X-ray techniques.

The Raman spectra of amorphous diamond superhard thin films will be studied for various deposition conditions to ascertain the microstructural film features that give rise to its unique physical properties.

Graphite intercalation compounds with basal plane conductivities approaching that of copper will be studied using light scattering techniques. The effect of intercalation on the intralayer vibrational excitations, as well as on the interlayer forces, will be examined to determine key aspects of electron-phonon coupling in these materials.

The tungsten bronze compounds NaxWO3 0 less than or equal to x less or equal to 1 exhibit a wide range of properties such as superconductivity, structural phase transitions, and a semiconductor to metal transition which depend drastically on the composition. NaxWO3 crystals will be prepared on the soft modes which drive structural transitions that give rise to superconductivity.

RESULTS: Irreversible photostructural changes in As2S3 films have been studied using Raman spectroscopy. The As2S3 vapor from which the films are prepared has also been studied. We find the vapor is quite complex and contains many molecular species including but not limited to As4S4, As4S6, As4, and S2. The film consists of a complex molecular glass which crosslinks on photon or thermal annealing. However, the molecular species in the glass are distinct from the vapor.

Using low-frequency Raman and Brillouin spectroscopy, the structural correlation ranges of several amorphous compounds and alloys composed of Ge, As, S, and/or Se have been determined. Typical values are 6-8 A. The first evidence of vibrational excitations of large atomic clusters has been obtained from the Raman spectrum of GeSe2. The large cluster is a ring of 6 Ge atoms interconnected by Se atoms and has a diameter of 7 A very close to the structural correlation range. (Text Abridged.)

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0011, QUANTUM MANY-BODY PHYSICS

C. WOO, Northwestern University, School of Arts & Sciences, *Evanston, Illinois* 60201 (PHY73-05007 A03)

Theoretical research in formal quantum many-body theory initiated under NSF grant MPS73-5007A01 will be continued. Topics with applications to nuclear physics and astrophysics to be studied include: 1. Calculational techniques for Fermi systems; 2. Quantum crystals; 3. Surface properties of nuclear matter.

SUPPORTED BY U.S. Natl. Science Foundation

8.0012, INDIANA UNIVERSITY HIGH-ENERGY PHYSICS GROUP

B.B. BRABSON, Indiana University, Res. Division, *Bloomington, Indiana* 47401 (E(11-1)-2009,0TASK A)

During the period Dec. 1, 1976, through Nov. 30, 1977, we plan to participate in high-energy physics experiments at the Fermi National Accelerator Laboratory (FNAL) at the Argonne Zero-Gradient Synchrotron (ZGS), and at CERN Super Proton Synchrotron (SPS). We will also complete an analysis of an experiment performed at SLAC and will undertake development work for a possible experimental program at PEP. In one of the FNAL experiments, the polarization of recoil protons from elastic p-p scattering will be measured for 20 GeV/c less than PLAB less than 400 GeV/c for absolute value of t between 0.2 and 2.0 (GeV/c) to the 2 power. This experiment is being done in the internal target area and will use a gas jet in conjunction with a recoil proton spectrometer and a carbon analyzer. In the other Fermilab experiment a Caltech-FNAL- UICC-Indiana-UCLA group will use a multiparticle spectrometer to make a global study of reactions in which one of the final-state particles or group of particles carries off large transverse momentum. In the ZGS experiment, the polarized beam and a carbon polarimeter will be used to measure the polarization, depolarization, and asymmetry parameter in inclusive p-p scattering. A Saclay-Indiana group will conduct a charmed particle search at the CERN SPS. This experiment will utilize a vertex spectrometer to look at the decay products of charmed particles triggered by the presence of two micron. Thus the 2 micron decay of the psi will be used to enrich the charmed particle component of our data. The analysis of the SLAC experiment, an Indiana-Vanderbilt-Purdue-SLAC effort, is nearly complete. An automatic film measuring system (PEPR) is being used to analyze streamer chamber film from this experiment which is a search for manifestly exotic mesons with double charge created in negative pion d yields P fwd PsX--.

RESULTS: During the Dec. 1, 1975 - Nov. 30, 1976, contract year we completed construction of the apparatus for the FNAL polarization experiment and are analyzing preliminary data. We have collected data from 430,000 triggers in the FNAL experiment studying large Pt phenomenon. Preliminary physics results from these data are now being studied. (Text Abridged.)

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0013, ATOMIC PHYSICS WITH HIGHLY IONIZED IONS

P. RICHARD, Kansas State University, School of Arts & Sciences, *Manhattan, Kansas* 66506 (E(11-1)-2753)

An area of basic atomic physics using high-energy heavy ion accelerators with particular emphasis to the creation and study of ionic states will be pursued. In particular the following studies will be made: 1) the identification of atomic and ion specie through X-ray spectroscopy, 2) measurement of capture, ionization and charge transfer cross sections in gases, 3) measurement of differential cross sections for ionization, 4) measurement of ionization cross sections vs. target thickness in thin solid targets, 5) calculation of inner shell ionization and charge exchange, and 6) calculation of four-electron configurations of Ar ions.

RESULTS: During the 5 month period from 1 March 1976 to 31 July 1976, 17 scientific papers were published, 10 scientific papers were submitted for publication and 12 abstracts were published on a wide range of topics related to ion-atom interactions at high energies.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0014, LOW-TEMPERATURE AND NEUTRON PHYSICS STUDIES

C.G. SHULL, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (E(11-1)-3342)

The neutron spectrometers installed at the reconstructed MIT Research Reactor will be used in investigations of materials characterization and in fundamental neutron physics studies. Diamagnetic scattering in bismuth and copper will be studied leading to information on the diamagnetic currents induced by applied magnetic fields and a new neutron interferometer system is being developed for applications to solid-state and fundamental neutron physics.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0015, HIGH-ENERGY PHYSICS
A.M. CORMACK, Tufts University, School of Arts & Sciences, *Medford, Massachusetts* 02155 (EY-76-C-02-3023)

The Bubble Chamber Group will search for charmed particles in p-p interactions; study the production of neutral particles in 300 GeV/c pp interactions; examine the double diffractive process in pn and pp collisions at 300 GeV/c; search for I equals 0 neutral mesons in negative Kaon-p reactions at 6.5 GeV/c; study proton-neon collisions at 400 GeV/c for small space-time behavior; study weak interaction properties and search pn charmed particles in neutrino-deuterium interactions at Fermilab; and we will use the BNL Multiparticle Spectrometer System to study resonances decaying into Kaon*s Kaon*s and lambda-lambda bar. The photon group proposes to study hadron jets and di-muon production at Fermilab, to develop a back-scattered beam for measurement pSPEAR polarization, and for future PEP/PETRA use, and to study phi-meson and associated kaon-electron production at SLAK.

RESULTS: Upper limits for production of exotic baryon states sigma negative - pi negative from negative kaon d have been established. Properties of inclusive K zero and lambda zero production in negative kaon-p reactions have been determined. Evidence for charmed particle semi-leptonic decay has been measured to be 1.3 plus or minus 0.1 fermi by interference correlations. Pi 0, K 0 and lambda 0/lambda bar 0 production from 300 GeV/c pp interactions have been studied and the Mueller correlation parameter f2 00 has been measured. Differential cross sections for proton compton scattering have been measured at large angles: 2-6 GeV and 0.71-4.29 (GeV/c) squared momentum transfer.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0016, LASER AND OPTICAL PHYSICS 13410-P
M. LAX, City University of New York, School of Liberal Arts & Sci., *New York, New York* 10031 (DA0U5578; DAAG29 76 G0055)

To study (1) linear and nonlinear interaction of electromagnetic radiation with electric and magnetic polarization carrying excitations in condensed matter, (2) fluctuations in lasers and condensed matter including hydrodynamic instabilities, and (3) laser physics, including laser resonators, mode competition, light amplification. The use of interdependences between pyro, piezo, magneto, and electroptic properties of materials forms the basis for a part of electronic device technologies. The laser work is relevant to the design of high-power lasers that are desired to operate in a single longitudinal mode to obtain a powerful, narrowly focused beam. The Bernard instability finds application in cloud formation in meteorology and the Rayleigh-Taylor instability is applicable to lubrication and flow over curved surfaces.

(1) A unifying Lagrangian approach is used, for both dissipative and non-dissipative phenomena, emphasizing rotational and displacement invariance in addition to usual (e.g., crystalline) symmetries. (2) Using efficient methods of calculating correlation functions for Fokker- Planck systems, study the onset of Bernard and Rayleigh-Taylor instabilities and the onset of turbulence in laminar flows induced by thermal gradients and shear forces. (3) Corrections to the paraxial approximation to the Maxwell equations are obtained and used to investigate the effects of refraction, gain saturation and diffraction in laser amplifiers.

ADDENDA: Supporting agency address is: DARCOM Army Research Office Box 12211 Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0017, ELECTRONIC STRUCTURE OF DEFECTS IN OXIDES
G.P. SUMMERS, Okla. St. Univ., School of Arts & Sciences, *Stillwater, Oklahoma* 74075 (E(40-1)-4837)

OBJECTIVE: The object of the proposed research is to investigate further the changes produced in the photoresponse of single-crystal samples of CaO, SrO, ZnO and alpha-Al2O3 by the introduction of structural defects and impurity ions. From these measurements, and also luminescence and fluorescence lifetime measurements, we propose to add to to our knowledge of the electronic structure of defects in these materials. In particular, we are concerned with the F ion-center, which consists of a single electron trapped at an anion vacancy and the F- center, which consists of two electrons trapped at an anion vacancy. The measurements are compared to recent calculations of the electronic structure of simple defects in the alkaline earth oxides. In the case of alpha-Al2O3 and ZnO where simple defects are not so well characterized our measurements are also aimed at determining the defect production mechanism. We also propose to determine the nature of the mechanism which leads to large photoconductivity from small concentrations of ion group impurities in alpha-Al2O3. Measurements are made of the spectral response and temperature dependence of photoconductivity and luminescence of unirradiated samples and samples which were irradiated with electrons or protons. Photocurrents will be detected either using an electrometer or a microwave cavity Q spoiling technique.

RESULTS TO DATE: Photoconductivity has been detected from F ion- centers in CaO and SrO. The thermal activation energy for photoconductivity is about 0.24 eV for CaO and 0.12 eV for SrO. Photoconductivity from F-centers in CaO indicate that the exicted state is very close to the conduction band.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0018, THEORETICAL STUDIES OF NUCLEAR STRUCTURE AND NUCLEAR REACTIONS
N. AUSTERN, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (PHY76-81104)

Theoretical research on nuclear structure and reactions and related studies of medium-energy meson-nucleus processes and of multiple scattering theory initiated under NSF grant PHY75-01397 AO1 will be continued.

The nuclear structure work emphasizes a large-scale study of properties of the shell-model effective interaction, derived by the systematic selection of a limited part of Hilbert space. Careful study is given to the singularities of this effective interaction. Techniques for overcoming these singularities and for other improvements to the effective interaction are being developed.

A vigorous program in 'medium-energy nuclear physics' will be continued. Computer codes developed for meson-nucleus collision studies have been improved and generalized so they can be used more conveniently at Pittsburgh and made available to others. Applications to kaon scattering are under way, as are studies of mesic atoms and of pion photoproduction and capture. Much of this work is in collaboration with experimental groups at Carnegie-Mellon University and at LAMPF. Other medium-energy work concerns fundamentals of multiple scattering theory, with particular attention to corrections to closure and to the impulse approximation.

SUPPORTED BY U.S. Natl. Science Foundation

8.0019, IONIZATION PHENOMENA
R.L. WATSON, Texas A & M University System, Cyclotron Institute, *College Station, Texas* 77843 (E(40-1)-4325)

It is proposed to perform further high-resolution measurements of ion-excited K alpha X-ray spectra to complete a study of the effect of chemical environment on K alpha X-ray satellites produced in heavy-ion collisions. In addition, a detailed investigation of the energy dependence of single K-plus multiple-L-shell ionization by He, C, O, Ne and Ar ions will be brought to a conclusion.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0020, PROPOSED TECHNICAL PROGRAM FOR ATOMIC COLLISIONS - ION SOURCE DEVELOPMENT
L.W. ANDERSON, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (EY-76-C-02-0007, TASK B)

Experiments on atomic collisions of importance in ion source research are proposed. We plan to continue our research on the direct production of H minus and D minus ions from a polarized atomic beam of H zero or D zero atoms. We plan to study the formation of H minus or D minus ions by charge exchange collision in a Rb vapor target. We also plan to remeasure the negative ion

equilibrium fraction when H ion of D ion is incident on a Cs vapor target. We plan to continue our measurements on the collisional stripping of H minus or D minus ions to form fast H degree or D degree atoms. We propose to measure the cross sections for various charge exchange collisions that are important in the production of beams of fast negative ions or of fast neutral atoms.

RESULTS: We have measured the total cross sections sigma plus zero for H ion, H2 ion, D ion, D2 ion, D3 ion, He ion,.N ion, N2 ion, Ar ion, Kr ion, and Xe ion incident on a Cs target in the energy range 30 - 220 keV. We have studied the production of He minus ions in a Rb vapor target, and we have made preliminary measurements on the production of H ion or D ions in a Rb vapor target. We are currently making measurements on the collisional stripping of H minus or D minus ions to form fast H zero or D zero atoms in a Cs vapor target. We are currently carrying out experiments on the direct production of polarized D minus ions from a polarized beam of D zero atoms.

Part 2 of 2.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0021, MESONIC ATOMS AT LAMPF - TASK B
R. KUNSELMAN, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (EY-76-S-02-2197)

Data have been taken in an experiment to measure the cross section for negative pion plus p yields negative pion plus positive pion plus n at 6 incident energies between 225 and 350 MeV and are now being analysed to yield the doubly differential cross sections d2 sigma over d omega dT for the outgoing positive pion in the center of momentum and the total cross sections for single pion production. The accuracy of the total cross sections should eventually be plus or minus 6%. The soft pion contribution will be extracted from these results and compared with theory to place narrow limits on zeta, the symmetry breaking parameter. A subsequent experiment with another charge state will confirm or deny the theory. If the theory is upheld, the present experiment will determine Ao, the isoscalar pi-pi scattering length, with about plus or minus 6% accuracy. Should the theory fail, aO may be extracted but with less accuracy. Further data on this reaction will be gathered at 200 and 225 MeV when LAMPF operates at 300 micron A. In another experiment, the cross sections for positive pion and negative pion double charge exchange in the disintegration of 16O, 40Ca, and 208Pb wwll be measured. Comparison with theory should indicate the importance of double scattering, pi-pi scattering, 3,3 resonance exchange, and nucleon-nucleon correlation in this process. A successful understanding of double charge exchange to the continuum should be an asset in calculating the cross section for specific isobar analog states.

Primary goals for this year are: (1) completing the analysis of data on hand for negative pion plus p yields negative pion plus positive pion plus n, (2) preparing and operating the experiment to measure double charge exchange, (3) proposing the measurement of negative pion plus p yields negative pion plus positive pion plus n at 200 and 225 MeV with higher intensity, and (4) proposing an experiment to measure negative pion plus p yields negative pion plus zero pion plus p.

The initial analysis of all data taken in the measurement of negative pion plus p yields negative pion plus positive pion plus n at 6 energies between 225 and 350 MeV will be completed by the end of the present contract year. (Text Abridged.)

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, INVESTIGATION OF THE 1-0 QUADRUPOLE SPECTRUM OF H2 IN ASTRONOMICAL OBJECTS
J.E. GAUSTAD, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST76-80198)

A study of infrared emission in molecular hydrogen in astronomical objects will be made. This infrared radiation has been recently observed in the Orion nebula and the planetary nebula NGC 7027. Three aspects of the problem will be pursued: (1) The intensity of the different lines in the band will be measured in order to find out how these lines are excited. (2) A search will be made for molecular hydrogen emission in other astronomical objects and a mapping will be made of the distribution of intensity in known molecular hydrogen emission sources. (3) The radial velocity and line profile of these lines will be found in order to understand the dynamics of the region producing the emission. A Fabry-Perot spectrometer will be developed. This instrument will be optimized for the study of the molecular hydrogen lines near two microns.

SUPPORTED BY U.S. Natl. Science Foundation

10.0002, THE TEMPERATURE STRUCTURE OF THE INNER SOLAR CORONA
D.E. BILLINGS, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (ATM76-04048)

This grant will support further studies on the thermal, density, kinetic and energetic structure of the solar transition zone and lower corona under varying conditions of solar activity. These analyses will be based upon observational data obtained by Skylab, the Orbiting Solar Observatories (OSO) 6, 7, and 8 and by various rocket flights. These data on X-rays and the extreme ultraviolet (EUV) will be compared with ground-based coronal and chromospheric observations with the aim of distinguishing between various theoretical models of the solar atmosphere. Specific objectives of this work include the following: a) develop statistical models for active regions, b) refine the computation of selected atomic parameters in order to better calculate temperatures representative of various types of regions on the solar surface, c) continue the analysis of spectroscopic line profile data in order to refine the hydrodynamic model of the solar atmosphere, d) study the overall energy balance of energy in the corona.

The ultimate aim of this work is to further our understanding of the way in which energy is allowed to flow from the solar interior through the solar atmosphere and into interplanetary space.

SUPPORTED BY U.S. Natl. Science Foundation

10.0003, NAVIGATION - POSITIONS AND INTENSITIES OF GALACTIC RADIO SOURCES
G.W. WETHERILL, Carnegie Inst. of Washington, *Washington, District of Columbia* 20005 (DN524402; N00014-76-C-1041)

Knowledge of positions, intensities and other properties of galactic radio sources is required for the design and development of advanced naval communications and navigation systems. A radio telescope at Derwood, Maryland, is used for this purpose.

To study hydrogen and other gas concentrations around galactic stars, and to understand the role of these gases in stellar birth and evolution. These studies are accomplished by use of a large parabolic antenna collector, and subject equipment is being used as a counterweight for the parabolic reflector. Knowledge of the galaxy gained from this research will lead to improved navigation capabilities.

ADDENDA: Supporting agency address is: Office of Naval Research 427, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0004, COMPILATION OF REFERENCE STAR CATALOGS
J.L. SCHOMBERT, U.S. Navy, Observatory, *Washington, District of Columbia* 20390 (DN546021)

Compile catalogs of accurate positions of 20,000 reference stars in each hemisphere of sky in support of Naval Observatory mission in time determination and navigation.

(1) Reduce all reference star observations made with Naval Observatory seven-inch transit circle telescope at El Leoncito, Argentina, to a system of reference defined by fundamental stars; (2) coordinate observations of reference stars being made at 20 cooperating observatories; (3) collect all results of observations of reference stars; analyze and compile catalogs of final positions.

ADDENDA: Supporting agency address is: Naval Observatory, Washington, DC 20390

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0005, STUDIES OF MAGNETIC PECULIAR A STARS
S.J. ADELMAN, Boston University, School of Arts & Sciences, *Boston, Massachusetts* 02215 (AST76-06233)

The proposed research will be a dual program of observational and theoretical studies of the sharp-lined magnetic Ap stars. Spectroscopic and spectrophotometric observations of these stars will be used for line identification and abundance analysis studies. A study will be made of how magnetic fields in these stars affect the observed properties through the process of radiative diffusion. This process has been postulated as the basis for the observed abundance anomalies in these stars. A set of computer-generated chemical inhomogeneous stratified model atmospheres will be computed and the observational predictions made by such models will be compared with actual observations. The evolution, in time, of an Ap star will be computed in order to determine the basic physical parameters that affect the atmospheres of these stars.

SUPPORTED BY U.S. Natl. Science Foundation

10.0006, THEORETICAL GALACTIC DYNAMICS AND HIGH-ENERGY ASTROPHYSICS
J.P. OSTRIKER, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (AST76-20255)

Theoretical research will be directed toward a number of astrophysical topics. Answers will be sought to questions such as: In what form is the dark mass which we know exists in the outer parts of galaxies? Is there any simple way that the Hubble sequence of galaxy forms can be understood as a variation of a single parameter defining the initial state of a protogalaxy? Is either the size or mass of galaxies understandable from physical principles or are these broadly distributed parameters having no preferred values? What are the globular cluster and galactic center X-ray sources? Could they be large black holes accreting diffuse gas? Can the energy (rather than momentum) absorbed by accreting gas be so large as to inhibit the accretion giving a limit like the Eddington limit? Will turbulence in accretion disc produce hot coronae and winds, thus invalidating the assumptions on which the standard models for X-ray sources are based? Do embedded pulsars make a significant contribution to supernova dynamics? Can the collection of galactic supernova effectively sweep out almost all of the intercloud medium producing the hot gas seen by the Copernicus satellite? These questions are a sample of those that will be considered by Ostriker. His creative theoretical ideas lay the ground work for others for a variety of astrophysical problems.

This is a continuation of work previously supported by NSF grant AST 75-22905.

SUPPORTED BY U.S. Natl. Science Foundation

10.0007, SPECIAL FOREIGN CURRENCY AWARD TO STUDY EVOLUTIONARY STATUS OF THE RS CVN AND U GEM TYPES OF CLOSE BINARY SYSTEMS (ABBREV)
J. SMAK, Polish Academy of Sciences, *Warsaw, Poland* (INT76-80588)

The N. Copernicus Astronomical Center of the Polish Academy of Sciences, Professor Jozef Smak, Principal Investigator, proposes to study close binary systems, one of the most challenging and significant fields in stellar astrophysics, in cooperation with Professor John P. Oliver, University of Florida, and Douglas S. Hall, Dyer Observatory, Vanderbilt University. The researchers in this cooperative effort will jointly use the resources of the N. Copernicus Astronomical Center in Warsaw and the Kitt Peak National Observatory.

The study of the properties and evolutionary status of the RS CVn and Gem type of binaries will include the following topics: 1. A model and evolutionary history of the peculiar binary V 471 Tau. 2. Determination of the basic physical characteristics of U Gem, as a prototype of the U Gem type binaries. 3. Discussion of the properties of two eruptive binaries: T CrB and VZ Scl. 4. Study of the ultra- short period, transient oscillations in the U Gem type binaries at their outbursts. 5. Characterization, based on photoelectric and spectroscopic data, of the physical characteristics of RS CVn type binaries. 6. Models, involving the stellar wind mechanism, to describe the present evolutionary status of the RS CVn type binaries. 7. Survey of models, including the stability analysis, of the mass-accreting white dwarfs, with application to the U Gem type binaries.

SUPPORTED BY U.S. Natl. Science Foundation

10.0008, HIGH-ENERGY ASTROPHYSICS
P.E. BOYNTON, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (AST75-07769 A01)

Recent results obtained by the author have improved the phenomenological understanding of the variable X-ray and optical source Hercules X-1 (HZ Hercules). The system is unusual in that it presents many clearly defined, reproducible, periodic phenomena: 1.24 second pulsations, 1.7 day eclipses, and variations of the X-ray flux on a 35 day cycle. The spectral line shapes and velocity curves of the stellar component of this binary will be calculated in order to obtain estimates of the masses of both components. Estimates will be made of accretion disc parameters. Optical data will be analyzed in order to determine the history of the period of the 35 day cycle from past observations. The theoretical models of the X-ray source with data obtained from the SAS-3 and Ariel V satellites in order to obtain a better understanding of the physical processes of mass transfer from the star. Numerical studies will be made of the mass transfer. The origin of the X-ray pulsations will be examined.

SUPPORTED BY U.S. Natl. Science Foundation

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N77-19989*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE INFLUENCE OF PITCH-LAG COUPLING ON THE PREDICTED AEROELASTIC STABILITY OF THE XV-15 TILTING PROPROTOR AIRCRAFT

Wayne Johnson Feb. 1977 22 p refs Prepared in cooperation with the US Army Air Mobility R and D Lab., Moffett Field, Calif.

(NASA-TM-X-73213; A-6946) Avail: NTIS HC A02/MF A01 CSCL 01A

The predicted dynamic stability of the XV-15 tilting proprotor aircraft in cruise flight is updated, using a reduced increase in the pitch gimbal coupling with collective, and a higher nominal control system stiffness. The major influence of the pitch-lag coupling of the XV-15 gimballed, stiff-inplane rotor on the aircraft stability is shown. The influence of the blade pitch dynamics is found to be contained primarily in the quasistatic pitch-lag and pitch-gimbal coupling, although the complete dynamics is retained in the analysis for an accurate quantitative calculation of the stability boundary. Author

N77-19990# Advisory Group for Aerospace Research and Development, Paris (France).

PREDICTION OF AERODYNAMIC LOADING

Feb. 1977 330 p refs Conf. Proc. of the Fluid Dynamics Panel Symp., NASA Ames Research Center, Moffett Field, Calif., 27-29 Sep. 1976

(AGARD-CP-204; ISBN-92-835-1238-4) Avail: NTIS HC A15/MF A01

Theoretical and semiempirical methods for determining expected aerodynamical loads and comparison with experimental data from wind tunnels or flight tests. For individual titles, see N77-19991 through N77-20016.

N77-19991# Hawker Siddeley Aviation Ltd., Kingston upon Thames (England).

EXAMPLES OF LOAD PREDICTION DIFFICULTIES **c05**

C. L. Bore *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 6 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

An interactive engine surge example of load prediction is used to show how novel design features cause major prediction problems. It is also shown that loads due to pressure fluctuations under separate boundary layer conditions, loads arising from uncommanded maneuvers, control actions of pilots that dominate the fatigue spectrum, and various aspects of fin loads are difficult to predict. G.G.

N77-19992# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany). Dept. of Aerodynamics.

SECTIONAL LOADS TECHNIQUE. PART 1: TEST TECHNIQUE. PART 2: TEST RESULTS **c02**

H. P. Franz and B. Ewald *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 16 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

A sectional load model technique is reported that measures aerodynamic loads of nearly arbitrarily split sections of the wind tunnel model separately by means of strain gage balances. This method provides both the overall aerodynamic loads acting on the model and the integral partial loads acting on those structural components of the airplane which are of particular interest for the design of the aircraft. G.G.

N77-19993# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Dept. of Aerodynamics.

PREDICTION OF AERODYNAMIC LOADINGS ON THE LEADING-EDGE SLATS OF THE FOKKER F 28 AIRLINER **c02**

In AGARD Prediction of Aerodynamic Loading Feb. 1977 13 p (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

Prediction of aerodynamic loadings on leading edge slats of modern airliners is considered. Component load data are specified, which are based on wind tunnel data; test conditions thereof cover only a part of the complete field. This discrepancy is bridged by data extrapolation. Determination at the relevant conditions of more realistic loadings is an elaborate second phase of the prediction process. The whole procedure is illustrated for the slats, introduced on later versions of the F 28 airliner, with some discussion on problems for that particular case. Author

N77-19994# British Columbia Univ., Vancouver. Dept. of Mechanical Engineering.

PREDICTION OF AERODYNAMIC EFFECTS OF SPOILERS ON WINGS **c02**

G. V. Parkinson and P. Tam Doo *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 9 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

The prediction of aerodynamic loading on two dimensional airfoils with spoilers is extended to an experimental study of effects of base venting on two-dimensional spoiler performance, and to a theoretical and experimental study of effects of finite span of spoilers and wings. The effects of realistic amounts of base venting on lift and pressure distribution proved small, so that unvented spoiler theory can be used with acceptable accuracy. Lifting line theory, requiring the sectional values of lift curve slope and zero lift angle as inputs, was used for the finite span study, and the theoretical predictions were compared with experimental data from reflection plane wind tunnel tests. Results are presented for lift and rolling moment, and agreement is good. The overall result is that the performance of finite span, base vented spoilers on finite span wings can be predicted with acceptable accuracy, with only the spoiler base pressure as an empirical input. Author

N77-19995# Vought Corp., Dallas, Tex. Systems Div.

A TECHNIQUE FOR PREDICTING EXTERNAL STORE AERODYNAMIC LOADS **c02**

A. R. Rudnicki, Jr., E. G. Waggoner, Jr., and R. D. Gallagher *In* AGARD Prediction of Aerodynamic Loading Apr. 1977 13 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

A technique has been developed for predicting six-component airloads on captive stores for single and multiple carriage configurations. The prediction method includes techniques for predicting the basic airload as well as the incremental airloads due to aircraft yaw and adjacent store interference. The single carriage prediction technique is valid for the Mach number range 0.5 to 2.0 while the multiple carriage technique was developed for the Mach range 0.5 to 1.6. The basic approach to the prediction technique was an empirical correlation of a large experimental data base consisting of literature survey data and data obtained from a parametric wind tunnel test. Author

N77-19996# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Aerodynamik.
PREDICTION OF EXTERNAL STORES AND TIP-TANK LOADS ON WING-FUSELAGE CONFIGURATIONS c02
S. R. Ahmed *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 18 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

An evaluation of a first order panel method to predict the six component aerodynamic forces and moment on captive stores and tip-tanks mounted on a wing-fuselage configuration is presented. The method has been tested on two accounts: prediction of surface pressure distribution, and estimation of the resulting forces and moments. The main investigation dealt with three geometric parameters: store chordwise and spanwise location below the wing, and the wing mid-chord sweep. Influence of Mach number was investigated separately over a range of 0 to 0.9. Store/pylon/fin and wing/tip-tank interactions were studied on basis of calculated surface flow patterns. The method was next applied to calculate the forces and moments acting on an extreme forward, central and extreme rearward located tip-tank on the swept wing-fuselage configuration. Comparisons between wind tunnel data and results of inviscid flow analysis are included for high subsonic speeds. Author

N77-19997# Saab-Scania, Linkoping (Sweden).
COMPARISON OF PREDICTED AERODYNAMIC LOADING WITH FLIGHT TEST RESULTS c02
Jan Kloos *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 7 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

Four load prediction problems of the more intricated kind are considered. In the first three cases, prediction of loads on wing mounted external stores during rolling pull-outs, prediction of fin loads during fast rolling maneuvers, effect of airframe elasticity on load distribution, it is shown how wind tunnel data, combined with fairly simple computation procedures, provide adequate load predictions that are in good agreement with flight test results. Results from the first stage of a flight test program to study loads due to encounter with wing-tip vortices from aircraft at high load factors are shown. Author

N77-19998# Systems Research Labs., Inc., Newport News, Va. RASA Division.
WING-VORTEX LIFT AT HIGH ANGLES OF ATTACK c02
Richard P. White, Jr. *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs (For primary document see N77-19990 11-01)
(Contract N00014-74-C-0091)
Avail: NTIS HC A15/MF A01

It has been determined that the maximum lift generated by a low aspect ratio swept wing can be increased by 60 percent due to the suction and induced effects of attached vortex flows. The manner in which the vortex flows effect the performance characteristics of the lifting surface is discussed in terms of the measured performance characteristics, surface pressure distribution and the results of flow visualization studies. Methods of further enhancing the performance characteristics of low aspect ratio wings by means of controlled vortex flows are discussed briefly. In addition, the correlation of theoretical predictions based on a refined theoretical analysis technique with experimental results is presented. Author

N77-19999# Lockheed-Georgia Co., Marietta.
VORTEX/JET/WING INTERACTION BY VISCOUS NUMERICAL ANALYSIS c02
R. M. Scruggs (Sybucon, Inc.), J. F. Nash (Sybucon, Inc.), and Charles J. Dixon *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs Sponsored by the Office of Naval Research (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

A computational model has been developed for analyzing the flow mechanism of vortex/wing/jet interactions. The model is applicable to a wide class of viscous flows but is particularly suitable for calculating vortex-type flows near no-slip or solid boundaries. Examples are leading edge vortices formed on highly swept delta wings or on moderately swept wings with active control by jets or passive control by strakes. The model is based on reducing the full Navier-Stokes equations to parabolic form with respect to one of the three space coordinates. Examples of computations for various vortex/wing/jet interactions are presented. Experimental pressure, laser velocimeter, and flow visualization data are presented for an unswept wing with leading edge vortex control by spanwise blowing. These data are used to analyze the formation and strength of the leading edge vortex and as examples of typical input/output data for the computational model. Author

N77-20000# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISONS OF THEORETICAL AND EXPERIMENTAL PRESSURE DISTRIBUTIONS ON AN ARROW-WING CONFIGURATION AT SUBSONIC, TRANSONIC, AND SUPERSONIC SPEEDS c02
Marjorie E. Manro (Boeing Commercial Airplane Co., Seattle), Percy J. Bobbitt, and John T. Rogers (Boeing Commercial Airplane Co., Seattle) *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 14 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

A wind tunnel test of an arrow wing body configuration consisting of flat and twisted wings, as well as a variety of leading- and trailing-edge control surface deflection, has been conducted at Mach numbers from 0.40 to 2.50 to provide an experimental data base for comparison with theoretical methods. Theory-to-experiment comparisons of detailed pressure distributions have been made using current state-of-the-art attached- and separated-flow methods. The purpose of these comparisons was to delineate conditions under which these theories are valid for aeroelastic calculations and to explore the use of empirical methods to correct the theoretical methods where theory is deficient. It was determined that current state-of-the-art attached flow and empirical methods were inadequate to predict aeroelastic loads for this configuration. Author

N77-20001# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
THREE DIMENSIONAL SUPERSONIC FLOW ABOUT SLICED BODIES c02
Guido Colasurdo and Maurizio Pandolfi *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 7 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

Three dimensional supersonic flows about aircrafts or reentry vehicles are computed by a marching technique along the body axis. Beside the well known features of these flows (3D bow and imbedded shocks, entropy layers, etc.) difficulties arise when the body surface presents lines of discontinous variations of its slope. It is shown that the numerical prediction of the pressure at the body comes out quite wrong if the slope discontinuities of the surface of the body are not taken in the proper consideration. A methodology is given in order to implement easily the capabilities of existing computer programs in case of these kinds of bodies. It is based on the explicit computation of the flow properties on the two sides of the discontinuity at the body by using there a local analysis. Author

N77-20002# National Aeronautical Establishment, Ottawa (Ontario).

A METHOD FOR ESTIMATING THE LOADING DISTRIBUTION ON LONG SLENDER BODIES OF REVOLUTION AT HIGH ANGLES OF ATTACK IN INCOMPRESSIBLE FLOW **c02**

E. Atraghji *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 20 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

The three dimensional flow over long slender bodies of revolution at high angles of attack is treated by relating it to the oscillatory two-dimensional flow over a circular cylinder normal to the stream. The approach leads to simple algebraic expressions for the local normal and side forces as functions of the cross flow Strouhal number and the ratio d/l (where d is the body diameter and 1 is the pitch length of the Karman vortex street observed in the cross flow plane). A FORTRAN computer program has been generated for determining these forces, once a proper value is specified for the ratio d/l. Sample solutions have been computed and are compared with experiment. The analysis reveals that small changes in the applied value of the ratio d/l can result in large changes in the predicted magnitude of the forces, particularly, of the normal force. The effects of boundary layer displacement thickness, location of the point at which separation of the shear layers begins, and the impulsiveness of vortex shedding are studied and discussed. Comparisons with experimental data, obtained at Mach 0.5 at a Reynolds number 1.4x10 based on maximum diameter and free stream flow conditions, show good predictions of the normal force coefficient and its center of pressure location for a variety of body lengths and nose shapes when a specific value of the ratio d/l is applied.

Author

N77-20003# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ASSESSMENT OF EXISTING ANALYTIC METHODS FOR PREDICTION OF HIGH ANGLE-OF-ATTACK LOADS ON DELTA WINGS AT SUPERSONIC SPEEDS **c02**

Emma Jean Landrum and James E. Townsend *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 7 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

An assessment of the applicability of four loading prediction methods to high angle-of-attack conditions for simplified wing-body configurations is provided. The methods are: The tangent wedge approximation, the linear theory methods of Middleton and Woodward, and a shock-fitting finite-difference technique. Estimates obtained by these methods were compared with experimental pressure data on delta wings to examine the effects of Mach number, camber, sweep angle, and angle of attack. Results indicate that all of the methods provided reasonable estimates at moderate angles of attack. At these moderate angles of attack, the methods of Middleton and Woodward provided good estimates at Mach numbers higher than those usually associated with linear theory. Only the finite-difference method provided reasonable load estimates at high angles of attack.

Author

N77-20004# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

ON THE CALCULATION OF THE PRESSURE DISTRIBUTION OF WING-BODY COMBINATIONS IN THE NON-LINEAR ANGLE OF ATTACK RANGE **c02**

Gregor Gregoriou *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 11 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

Based on the potential theory, an iterative singularity method was developed which yields the pressure distribution of symmetric wing-body configurations in the nonlinear angle of attack range at subsonic speeds. The body is axis-symmetric and of finite length. The wing is infinitely thin and located at mid-wing position. The following mathematical model was used: (Wing) lattice method, free vortices partially inclined to the wing plane, and (Body) ring sources over the body surface. Theoretical results show good agreement with wind tunnel tests. Author

N77-20005# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany). Dept. of Aerodynamics.

PREDICTION METHOD FOR STEADY AERODYNAMIC LOADING ON AIRFOILS WITH SEPARATED TRANSONIC FLOW **c02**

P. G. Thiede *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

A method is outlined for transonic flows on airfoils, extending the boundary layer concept to regions of flow separation by coupling a viscous boundary layer solution with an inviscid external flow solution iteratively. For viscous flow in the separated region an inverse integral method is developed, defining the surface pressure as a dependent variable with a prescribed streamline angle at the boundary layer edge. For the inviscid flow, a finite difference method is used, which satisfies the complete transonic equation. Two coupling schemes with different boundary conditions for both the interacting flow fields are considered: Tangential coupling along the boundary layer displacement thickness, and tangential and normal velocity coupling along the boundary layer edge. The above method was verified with tests on a two dimensional bump in a transonic duct, and on a circular arc transonic airfoil, for which results of the Navier-Stokes solutions have been published. Results indicate that with the second boundary condition the present method is accurate enough for practical purposes provided that the separated regions have a moderate extension. Author

N77-20006# Aeronautical Research Inst. of Sweden, Bromma.

PRESSURE DISTRIBUTIONS FOR A SWEPT WING BODY CONFIGURATION OBTAINED FROM COUPLING TRANSONIC POTENTIAL FLOW CALCULATIONS AND BOUNDARY LAYER CALCULATIONS **c02**

Sven G. Hedman *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 9 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

A series of swept wings on cylindrical bodies has been designed, tested and analyzed. The wings have a common planform, a 35 deg swept quarter chord line, an aspect ratio of 4, and a taper ratio of 0.4. The relative thickness of the wings generally exceeds 8.5%. Comparisons between calculated and measured pressure distributions at two supercritical flow conditions M = 0.8, alpha = 6 deg and M = 0.9, alpha = 0 deg are reported. The pressures were calculated with a relaxation method based on the transonic small disturbance equation. Boundary layer displacement thicknesses were calculated both with an integral method and a finite difference method for three dimensional turbulent flow. It was found that the use of the simplified or the full boundary condition and of including the velocity potential function in the flow calculation affected the results only slightly. Addition of the boundary layer thickness to the wing thickness into an equivalent wing surface improved the agreement between calculated and measured pressures.

Author

N77-20007# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AERODYNAMIC LOADS NEAR CRANKS, APEXES, AND TIPS OF THIN, LIFTING WINGS IN INCOMPRESSIBLE FLOW **c02**

Richard T. Medan *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

The calculation of the incompressible and irrotational flow in the vicinity of tips and corners of thin, lifting wings is considered. It is shown that the important characteristics of the flow are governed by an eigenvalue problem, which is nonlinear at the trailing edge because of the shed wake (assumed to be in the wing plane). A new solution method was devised because either the existing methods were not valid for the trailing edge case or they would have required excessive amounts of computer time. The new method, which is fundamentally different than the previous ones, was used to calculate solutions for a number of cases, including some for which correct answers had not previously been obtained. Two of these solutions were used to

determine the validity of drag and leading-edge-suction distributions near the tips of a delta wing and a swept wing as calculated by using both the vortex lattice method and a kernel function method. The calculations for the swept wing resolved the question of whether or not the induced drag should be zero at the wing tip. Author

N77-20008# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Theoretical Aerodynamics Group.

VORTEX LATTICE APPROACH FOR COMPUTING OVERALL FORCES ON V/STOL CONFIGURATIONS c02

Ciro W. Lucchi and Wolfgang Schmidt *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 8 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

The vortex lattice method to handle lifting configurations of arbitrary shapes is described. Details on force computation when additional lift is induced by a deflected jet are also included. Vortex lattice methods improved computational accuracy so that induced drag and force distributions are now reliable results. Results are presented for such problems as mass flow control, jet definition, lattice arrangements on the centerbody, shroud and jet for wing tip winglets or shrouded propellers with highly deflected jets. Author

N77-20009# General Dynamics/Fort Worth, Tex.

AIRCRAFT MANEUVERS AND DYNAMIC PHENOMENA RESULTING IN RAPID CHANGES OF LOAD DISTRIBUTIONS OR/AND FLUCTUATING SEPARATION c05

David B. Benepe, Sr. *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 13 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

Flight data are presented from several maneuvers which produce rapid changes in aircraft component load distribution or/and fluctuating flow separations. The maneuvers include an abrupt pullup, slow and fast windup turns, a slowdown turn at elevated load factor, a rolling pullout at elevated load factor, a sustained rudder roll followed by a spin and recovery and a one g deceleration terminating in a slow nose slice and recovery. where feasible, wind tunnel model pressure measurements illustrate the character of the aerodynamic loadings. Comparisons between measured structural loads and predictions are presented and discussed. Author

N77-20010# Royal Aircraft Establishment, Farnborough (England). Dept. of Structures.

THE THEORETICAL PREDICTION OF STEADY AND UNSTEADY AERODYNAMIC LOADING ON ARBITRARY BODIES IN SUPERSONIC FLOW c02

D. L. Woodcock *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 21 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

A method is developed for the determination of aerodynamic forces on arbitrary oscillating (and possibly deforming) bodies in linearized irrotational supersonic flow. Use is made of an approximation to the body by a many sided polyhedron. The problem is reformulated as an integral equation of the second kind and its solution is obtained by collocation at the centroids of a large number of regions arranged in bands round the body. The number of regions is much larger than the number of facets of the polyhedron. The steady perturbation potential on the body is obtained as a necessary intermediate result. From the calculated velocity potential the steady and oscillatory components of the loading distribution and the overall forces are simply evaluated. The method is demonstrated by application to a fighter aircraft fuselage. Author

N77-20011# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

THE PREDICTION OF BUFFET ONSET AND LIGHT BUFFET BY MEANS OF COMPUTATIONAL METHODS c08

G. Redeker and H.-J. Proksch (Dornier G.m.b.H., W. Germany) *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 10 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

Computational methods are reported which are able to provide the project engineer with buffeting boundaries as a first design step of an aircraft. Discussed are: (1) the method of Thomas for predicting buffet onset for wing sections including supercritical airfoils at higher angles of attack, (2) the method of Redeker for predicting buffet onset for infinite yawed wings; and (3) the method of Proksch for predicting light buffeting for finite wings. The basic ideas of these methods are outlined and their applications are shown in comparison with experimental results. Author

N77-20012# Royal Aircraft Establishment, Bedford (England). Dept. of Aerodynamics.

PRELIMINARY EVALUATION OF A TECHNIQUE FOR PREDICTING BUFFET LOADS IN FLIGHT FROM WIND-TUNNEL MEASUREMENTS ON MODELS OF CONVENTIONAL CONSTRUCTION c08

G. F. Butler and G. R. Spavins *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 11 p refs (For primary document see N77-19990 11-01)

Avail: NTIS HC A15/MF A01

A technique is described for predicting buffet loads in flight from wind tunnel measurements of the response of models of conventional construction. The rms response and damping ratio in each mode are used to calculate non-dimensional buffet excitation and aerodynamic damping parameters, which are used in combination with the aircraft structural damping to predict the buffeting response under flight conditions. Results are presented from wind tunnel tests on a model of a small combat trainer aircraft and predictions made using these results are compared with flight measurements. In addition, some remarks are made on methods for determining rms response and damping ratio from accelerometer or strain gauge signals recorded under buffeting conditions. Author

N77-20013# Lockheed Missiles and Space Co., Sunnyvale, Calif.

QUASI-STEADY AND TRANSIENT DYNAMIC STALL CHARACTERISTICS c08

Lars E. Ericsson and J. Peter Reding *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 11 p refs (For primary document see N77-19990 11-01)

Avail: NTIS

Dynamic airfoil stall is characterized by two separate events: There is a substantial overshoot of the static stall angle and stall lift maximum before bona fide separation occurs, and after separation has occurred, a spilled lending edge vortex travels downstream over the chord causing large changes in the aerodynamic force distribution. The first event can be characterized as quasi-steady, whereas the second event is truly a transient phenomenon. An analysis is presented which extends the earlier developed quasi-steady theory to include the transient effect of the spilled leading edge vortex. The large effects of compressibility on the dynamic stall characteristics are also accounted for in the analysis. The analytic results are in good agreement with available dynamic experimental data. Author

N77-20014# General Dynamics/Convair, San Diego, Calif.

THEORY OF WING SPAN LOADING INSTABILITIES NEAR STALL c02

E. S. Levinsky *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 16 p refs (For primary document see N77-19990 11-01)

(Contract N62269-75-C-0356)

Avail: NTIS HC A15/MF A01

A nonlinear, lifting line procedure with unsteady wake effects has been developed for predicting wing-body aerodynamic characteristics up to and beyond stall. A discrete vortex lattice representation is used for the time dependent wake, whereas the wing load distribution is assumed concentrated along the 25% chord line. Each chordwise section is assumed to act aerodynamically (including stall) like a 2D airfoil in steady flow at an effective angle of attack, which may be time dependent. Other assumptions are incompressible flow, moderate sweep, large aspect ratio and conditions for stall progression across the span. Comparisons are made with existing theory and test data. Effects of planform geometry and of airfoil section characteristics on stall are presented. For airfoils with a large post-stall negative lift curve slope, the solutions sometimes exhibit lift hysteresis and zero-beta rolling and yawing moments. These results are

due to the existence of multiple solutions of the lifting line equations. Increasing aspect ratio and decreasing negative life curve slope amerliorates the severity of these adverse stalling characteristics. Author

N77-20015# Air Force Academy, Colo.
DYNAMIC LOADING ON AN AIRFOIL DUE TO A GROWING SEPARATED REGION c02
James D. Lang and Michael S. Francis *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

Experiments examining the unsteady growth of a separated region on an airfoil in incompressible flow are employed to verify aspects of a semi-empirical model which attempts to predict the loading and unsteady flow effects associated with the region. Measurements of surface pressures downstream of an oscillating fence-type spoiler confirm the existence of the two essential features of the model, namely, a lag in the growth of the separation zone due to the unsteady nature of the flowfield, and modification of the approximate roof-top pressure distribution associated with a separating and reattaching shear layer which occurs on a surface in steady flow. Also examined briefly are the effects of Reynolds number variation and the observation of secondary flow phenomena. Limitations of the model, including its inability to predict detailed spatial and temporal distributions of pressure behavior, are discussed along with recommendations for improvements. Author

N77-20016# Office National d'Etudes et de Recherches Aerospatiales, Modane (France).
PRESSURES OVER A SHARP-EDGED AIR INTAKE FUNCTIONING IN SUBSONIC FLOW AT REDUCED FLOWRATE c02
Gerard Laruelle and Paul Levart *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs In FRENCH; ENGLISH summary (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

A wind tunnel test set-up has been designed for studying the flow around the cowl with sharp leading edge of an air intake functioning at subsonic velocity and with a reduced flowrate. A comparison of the pressure fields around the intake lip, calculated in an approximate configuration for the free light and for that particular set-up, shows that local flows are correctly simulated in the case of moderately reduced flowrates. The forces acting on the air intake casing are dependent upon a separation bubble that forms on the external lip of the intake when the flowrate is sufficiently reduced. The method used for calculating the potential flow has been adapted to take account of this bubble, through parameters characterizing it. Author

N77-20745# British Airways Medical Service, Middlesex (England).
THE USE AND CONTROL OF HAZARDOUS MATERIALS IN AIRCRAFT MAINTENANCE
D. M. Bruton *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 3 p (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N77-20017*# Lockheed-California Co., Burbank.
ADVANCED AIRFOIL DESIGN EMPIRICALLY BASED TRANSONIC AIRCRAFT DRAG BUILDUP TECHNIQUE Final Report
W. D. Morrison, Jr. Jan. 1976 80 p refs
(Contract NAS2-8612)
(NASA-CR-137928; LR-27524) Avail: NTIS HC A05/MF A01 CSCL 01A

To systematically investigate the potential of advanced airfoils in advance preliminary design studies, empirical relationships were derived, based on available wind tunnel test data, through which total drag is determined recognizing all major aircraft geometric variables. This technique recognizes a single design lift coefficient and Mach number for each aircraft. Using this technique drag polars are derived for all Mach numbers up to MDesign + 0.05 and lift coefficients -0.40 to +0.20 from CLDesign. Author

N77-20018# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
TWO-DIMENSIONAL, LAMINAR, COMPRESSIBLE BOUNDARY-LAYER CALCULATIONS IN TURBOMACHINES
Roger Grundmann 1 Jul. 1976 30 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in July 1977
Avail: NTIS HC A03/MF A01

The second order boundary layer equations for steady, laminar, compressible flow relative to a rotating, intrinsic, orthogonal coordinate system are derived. The coordinate axes are fixed on a radial compressor blade. With a known inviscid velocity distribution on the blade surface along an arbitrary streamwise coordinate an approximately two-dimensional boundary layer, for which cross-flow is assumed to be negligibly small, is computed. A finite Mehrstellen difference scheme is employed to obtain non-similar solutions of the governing equations over the whole blade length from the stagnation point up to the separation point. The centrifugal and coriolis acceleration terms and the additional curvature terms have a strong influence on the location of the separation point. Author

N77-20019# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE USE OF AN EFFECTIVE REYNOLDS NUMBER TO PREDICT THE AERODYNAMICS OF HEATED CYLINDERS AND SPHERES AT SUBSONIC SPEEDS
James F. Marchman, III 28 Jan. 1977 34 p refs Backup document for AIAA Synoptic, "Effective Reynolds Numbers for Heated Spheres and Cylinders", scheduled for publication in AIAA Journal in July 1977
Avail: NTIS HC A03/MF A01

Subsonic wind tunnel tests were conducted on heated circular cylinders and spheres of varying roughness to determine aerodynamic drag at surface temperatures up to 1500 F in unheated flows. Test results revealed a temperature dependent reverse laminar-turbulent transition with laminar characteristics appearing at higher surface temperatures. An effective Reynolds number is proposed which explains the reverse transition and makes possible prediction of heated body behavior based on conventional unheated data. Author

N77-20020*# Analytical Methods, Inc., Bellevue, Wash.
FORMATION FLYING BENEFITS BASED ON VORTEX LATTICE CALCULATIONS
Brian Maskew [1977] 58 p refs
(NASA Order A-26151-B)
(NASA-CR-151974) Avail: NTIS HC A04/MF A01 CSCL 01A

A quadrilateral vortex-lattice method was applied to a formation of three wings to calculate force and moment data for use in estimating potential benefits of flying aircraft in formation on extended range missions, and of anticipating the control problems which may exist. The investigation led to two types of formation having virtually the same overall benefits for the formation as a whole, i.e., a V or echelon formation and a double row formation (with two staggered rows of aircraft). These formations have unequal savings on aircraft within the formation, but this allows large longitudinal spacings between aircraft which is preferable to the small spacing required in formations having equal benefits for all aircraft. A reasonable trade-off between a practical formation size and range benefit seems to lie at about three to five aircraft with corresponding maximum potential range increases of about 46 percent to 67 percent. At this time it is not known what fraction of this potential range increase is achievable in practice. Author

N77-20021*# Aeronautical Research Associates of Princeton, Inc., N. J.

GYC: A PROGRAM TO COMPUTE THE TURBULENT BOUNDARY LAYER ON A ROTATING CONE

Roger D. Sullivan Aug. 1976 102 p refs

(Contract NAS2-8014)

(NASA-CR-151981; Working Paper-76-2) Avail: NTIS HC A06/MF A01 CSCL 01A

A computer program, GYC, which is capable of computing the properties of a compressible turbulent boundary layer on a rotating axisymmetric cone-cylinder body, according to the principles of invariant modeling was studied. The program is extended to include the calculation of the turbulence scale by a differential equation. GYC is in operation on the CDC-7600 computer and has undergone several corrections and improvements as a result of the experience gained. The theoretical basis for the program and the method of implementation, as well as information on its operation are given. Author

N77-20022*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AEROX: COMPUTER PROGRAM FOR TRANSONIC AIRCRAFT AERODYNAMICS TO HIGH ANGLES OF ATTACK. VOLUME 1: AERODYNAMIC METHODS AND PROGRAM USERS' GUIDE

John A. Axelson Feb. 1977 37 p refs

(NASA-TM-X-73208-Vol-1; A-6927-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 01A

The AEROX program estimates lift, induced-drag and pitching moments to high angles (typ. 60 deg) for wings and for wingbody combinations with or without an aft horizontal tail. Minimum drag coefficients are not estimated, but may be input for inclusion in the total aerodynamic parameters which are output in listed and plotted formats. The theory, users' guide, test cases, and program listing are presented. Author

N77-20023*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AEROX: COMPUTER PROGRAM FOR TRANSONIC AIRCRAFT AERODYNAMICS TO HIGH ANGLES OF ATTACK. VOLUME 2: COMPARISONS OF TEST CASES WITH EXPERIMENT

John A. Axelson Feb. 1977 140 p refs

(NASA-TM-X-73208-Vol-2; A-6927-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 01A

For abstract, see N77-20022.

N77-20024*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AEROX: COMPUTER PROGRAM FOR TRANSONIC AIRCRAFT AERODYNAMICS TO HIGH ANGLES OF ATTACK. VOLUME 3: AEROX COMPUTER PROGRAM LISTING

John A. Axelson Feb. 1977 55 p

(NASA-TM-X-73208-Vol-3; A-6927-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 01A

For abstract, see N77-20022.

N77-20025*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LONGITUDINAL AND LATERAL-DIRECTIONAL STATIC AERODYNAMIC CHARACTERISTICS OF AN UNPOWERED ESCAPE SYSTEM EXTRACTION ROCKET MODEL

Jarrett K. Huffman, Charles H. Fox, Jr., and Robert E. Satterthwaite Mar. 1977 26 p refs

(NASA-TM-X-74009) Avail: NTIS HC A03/MF A01 CSCL 01A

An escape system extraction rocket proposed for use on the Rotor Systems Research Aircraft was tested at Mach numbers of 0.1 and 0.3 through an angle of attack range from -2 deg to 102 deg and an angle of sideslip range from 0 deg to 15 deg in the Langley 7- by 10-foot high speed tunnel. Author

N77-20026*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SEPARATED-FLOW UNSTEADY PRESSURES AND FORCES ON ELASTICALLY RESPONDING STRUCTURES

C. F. Coe, D. W. Riddle, and C. Hwang (Northrop Corp., Hawthorne, Calif.) Mar. 1977 54 p refs

(NASA-TM-X-73214; A-6948) Avail: NTIS HC A04/MF A01 CSCL 01A

Broadband rms, spectral density, and spatial correlation information that characterizes the fluctuating pressures and forces that cause aircraft buffet is presented. The main theme of the paper in describing buffet excitation is to show the effects of elasticity. Data are presented that were obtained in regions of separated flow on wings of wind-tunnel models of varying stiffness and on the wing of a full scale aircraft. Reynolds number effects on the pressure fluctuations are also discussed. Author

N77-20027*# North Carolina State Univ., Raleigh.

PREDICTION OF LIGHT AIRCRAFT HORIZONTAL TAIL ONSET FLOWS: A REVIEW AND ANALYSIS

Delbert C. Summey and Frederick O. Smetana Washington NASA Apr. 1977 130 p refs

(Grant NsG-1077)

(NASA-CR-2774) Avail: NTIS HC A07/MF A01 CSCL 01A

The theoretical basis of the two computer programs (WASH and WAKE) are developed. WASH calculates the location of wake-sheet streamlines behind the wing, and upwash and downwash angles ahead of and behind the wing, respectively. WAKE computes two-dimensional velocity profiles along the wake streamlines given the upper and lower surface velocity profiles at the wing trailing edge. Comparisons with experiment indicate good agreement for wake location, downwash angles, and two-dimensional velocity profiles at low to moderate angles of attack. The adaptation of the results of the two programs to predict the total onset flow at the tail is discussed. Author

N77-20028*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL EVALUATION OF NACELLE-AIRFRAME INTERFERENCE FORCES AND PRESSURES AT MACH NUMBERS OF 0.9 TO 1.4

Daniel P. Bencze Washington Mar. 1977 178 p refs

(NASA-TM-X-3321; A-6344) Avail: NTIS HC A09/MF A01 CSCL 01A

Detailed interference force-and-pressure data were obtained on a representative supersonic transport wing-body-nacelle combination at Mach numbers of 0.9 to 1.4. The basic model consisted of a delta wing-body aerodynamic model with a length of 158.0 cm (62.2 in.) and a wingspan of 103.6 cm (40.8 in.) and four independently supported nacelles positioned beneath the model. The experimental program was conducted in the Ames 11- by 11-Foot Wind Tunnel at a constant unit Reynolds number. The primary variables examined included Mach number, angle of attack, nacelle position, and nacelle mass-flow ratio. Under the most favorable conditions, the net interference drag was equal to 50 percent the drag of four isolated nacelles at $M = 1.4$, 75 percent at $M = 1.15$, and 144 percent at $M = 0.90$. The overall interference effects were found to be rather constant over the operating angle-of-attack range of the configuration. The effects of mass-flow ratio on the interference pressure distributions were limited to the lip region of the nacelle and the local wing surface in the immediate vicinity of the nacelle lip. The net change in the measured interference forces resulting from variations in the nacelle mass-flow ratio were found to be quite small. Author

N77-20029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A LOW-WING LIFT-FAN TRANSPORT INCLUDING HOVER CHARACTERISTICS IN AND OUT OF GROUND EFFECT

Danny R. Hoad and Garl L. Gentry, Jr. Washington Feb. 1977 150 p refs Prepared in cooperation with USAAMRDL, Hampton, Va.

(NASA-TM-X-3420; L-10942) Avail: NTIS HC A07/MF A01 CSCL 01A

The longitudinal aerodynamic characteristics of a six-fan, tip-driven (remote) lift-fan VTOL transport through transition were determined by an investigation conducted in the Langley V/STOL tunnel. Tests were also made with the large midspan lift-fan pods and lift-cruise fans removed to determine their their influence on the stability and control of the configuration. Data were obtained for a range of model height above ground. Author

N77-20030*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SIDE FORCES ON FOREBODIES AT HIGH ANGLES OF ATTACK AND MACH NUMBERS FROM 0.1 TO 0.7: TWO TANGENT OGIVES, PARABOLOID AND CONE

Earl R. Keener, Gary T. Chapman, Jamshid Taleghani, and Lee Cohen Washington Feb. 1977 141 p refs

(NASA-TM-X-3438; A-6670) Avail: NTIS HC A07/MF A01 CSCL 01A

An experimental investigation was conducted in the Ames 12-Foot Wind Tunnel to determine the subsonic aerodynamic characteristics of four forebodies at high angles of attack. The forebodies tested were a tangent ogive with fineness ratio of 5, a paraboloid with fineness ratio of 3.5, a 20 deg cone, and a tangent ogive with an elliptic cross section. The investigation included the effects of nose bluntness and boundary-layer trips. The tangent-ogive forebody was also tested in the presence of a short afterbody and with the afterbody attached. Static longitudinal and lateral/directional stability data were obtained. The investigation was conducted to investigate the existence of large side forces and yawing moments at high angles of attack and zero sideslip. It was found that all of the forebodies experience steady side forces that start at angles of attack of from 20 deg to 35 deg and exist to as high as 80 deg, depending on forebody shape. The side is as large as 1.6 times the normal force and is generally repeatable with increasing and decreasing angle of attack and, also, from test to test. The side force is very sensitive to the nature of the boundary layer, as indicated by large changes with boundary trips. The maximum side force caries considerably with Reynolds number and tends to decrease with increasing Mach number. The direction of the side force is sensitive to the body geometry near the nose. The angle of attack of onset of side force is not strongly influenced by Reynolds number or Mach number but varies with forebody shape. Maximum normal force often occurs at angles of attack near 60 deg. The effect of the elliptic cross section is to reduce the angle of onset by about 10 deg compared to that of an equivalent circular forebody with the same fineness ratio. The short afterbody reduces the angle of onset by about 5 deg.

Author

N77-20031*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF LOW-PRESSURE-RATIO FAN STAGE AT TWO OFF-DESIGN BLADE SETTING ANGLES

George Kovich, Edward R. Tysl, and Royce D. Moore Washington Mar. 1977 90 p

(NASA-TM-X-3447; E-8578) Avail: NTIS HC A05/MF A01 CSCL 01A

The overall and blade-element performance of a low pressure ratio, low tip speed fan stage at design speed is presented for tow off-design rotor blade angle settings. The rotor design tip speed is 243.8 m/sec and weight flow per unit annulus area is 175.8 kg/sec. Design weight flow and pressure ratio are 29.9 kg/sec and 1.151, respectively. Author

N77-20032*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AILERON AND KRUEGER NOSE FLAP EFFECTIVENESS MEASURED ON AN OBLIQUE WING

Edward J. Hopkins and George H. Lovette (ARO, Moffett Field, Calif.) Washington Mar. 1977 276 p refs

(NASA-TM-X-3459; A-6645) Avail: NTIS HC A13/MF A01 CSCL 01A

The effects that deflection of conventional ailerons have on the lateral/directional characteristics of an oblique wing mounted on top of a body of revolution were measured. The wing had an aspect ratio of 6 (based on the unswept wing span) and was tested at various sweep angles ranging from 0 deg to 60 deg. Krueger nose flaps mounted on drooped-nose flaps were investigated on the downstream wing panel (for sweep angles of 45 deg and 60 deg) in an attempt to create more symmetrical spanwise wing stalling at high lift coefficients. The tests were conducted over a Mach number range of 0.25 to 1.4 and an angle-of-attack range from -3 deg to 28 deg. With the oblique wing in the swept position, considerable difference in the aileron effectiveness was measured for positive or negative differential aileron deflections. With the wing swept 45 deg at a Mach number of 0.8 and above, an extension of the span of the Krueger nose flaps on the downstream wing panel did not improve the linearity of the pitching-, rolling-, and yawing-moment curves. Author

N77-20033*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUPERSONIC AERODYNAMIC CHARACTERISTICS OF A SERIES OF WRAP-AROUND-FIN MISSILE CONFIGURATIONS

Roger H. Fournier Washington Mar. 1977 174 p refs

(NASA-TM-X-3461; L-11153) Avail: NTIS HC A08/MF A01 CSCL 01A

A parametric study of wrap-around-fin missile configurations was conducted at Mach numbers from 1.60 to 2.86 in the Langley Unitary Plan wind tunnel. The fin configurations investigated included variations in chord length, leading edge sweep, thickness ratio, and leading edge shape. The investigation also included a smooth and a stepped-down afterbody required for flush retraction of the wrap-around-fin configuration. The investigation indicated no unusual longitudinal characteristics; however, all the wrap-around-fin configurations tested indicated erratic lateral behavior, particularly in the form of induced roll at zero angle of attack and irregular variations of roll with angle of attack and Mach number. The magnitude of rolling moment at an angle of attack of 0 deg is estimated to represent approximately 0.25 deg or less roll control deflection. The stepped-down afterbody has a marked effect on reducing the induced roll. Author

N77-20034# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.

A FINITE DIFFERENCE SCHEME FOR CALCULATION OF SUPERSONIC THREE-DIMENSIONAL FLOW FIELDS AROUND BLUNT BODIES

Claus Weiland 10 Nov. 1976 76 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-366)

(DLR-FB-76-57) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 30,40

An explicit-implicit finite difference scheme is given for the calculation of three-dimensional inviscid flow fields around blunt bodies. This procedure should be applied essentially in the stagnation point domain, where subsonic and supersonic regions exist together. A detailed presentation is given of the complete necessary systems of equations, the needed coordinate transformations being discussed in detail. Subsequently, the method of solution of the difference equations is described. In addition to fully three-dimensional 3-D axial symmetrical flow fields, (2-D) are also calculated. The particularities of these flow fields are discussed briefly. Listings for 3-D and 2-D flows as well as a 3-D sample calculation are included. Author (ESA)

N77-20035# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

A METHOD FOR CALCULATING TURBULENT BOUNDARY LAYERS USING A FORMULATION OF FIRST GRADIENT Ph.D. Thesis - Claude Bernard Univ., Lyon, 1975

Pierre-Marc Riboud Oct. 1976 66 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-368)

(ONERA-NT-1975-8) Avail: NTIS HC A04/MF A01

The method aims at writing a computer program for calculating boundary layers blown at the hinge of a lift-augmenting flap. The proposed computing method makes use of an equation governing the behavior of the Boussinesq coefficient whose formulation was given by Nee and Kovasznay in the case of an incompressible boundary layer. It is pointed out that, in the internal turbulence zone, the expression of local equilibrium, production= dissipation, is coherent with that of the logarithmic law of the wall velocity. This fact makes it possible to deduce the production and dissipation terms from the form taken by the logarithmic law for compressible boundary layers and to generalize the Nee-Kovasznay equation to such flows. In the same manner, the persistence of a logarithmic law when the turbulent zone near the wall is the seat of mechanisms other than turbulent energy production and dissipation leads one to

make use of a formalism imagined by Bradshaw and to modify the dissipation length to take implicitly into account these supplementary mechanisms. One then knows how to link the new value of this length to that of the slope of the logarithmic law, so that it is possible to calculate the wall jet and the boundary layer blowing on deflected and undeflected flaps. The numerical method is that of Spalding-Patankar, with alterations concerning the calculation of the entrainment rate and of the velocity profiles in the viscous layer, as well as the introduction of wall curvature effects on the static pressure crosswise evolution. Author (ESA)

N77-20036# Ruhr Univ., Bochum (West Germany).
EXAMPLES FOR APPLICATION OF HIGHER ORDER BOUNDARY LAYER THEORY TO THE HYPERSONIC FLOW AROUND A TRANSVERSALLY CURVED CYLINDER SURFACE [BEISPIELE ZUR ANWENDUNG DER GRENZ-SCHICHTTHEORIE HOEHERER ORDNUNG FUER DIE UEBERSCHALLSTROEMUNG AN EINER TRANSVERSAL GEKRUEMMTEN ZYLINDERFLAECHE]
V. VasantaRam Bonn DOKZENTBw 1976 44 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-76-17) Avail: NTIS HC A03/MF A01; DOKZENTBw DM 30

A collection is presented of heat-transfer calculations on hyperbolic cylinders with axes parallel to the undisturbed supersonic flow. The object of the calculations is to illustrate the application of a more general theory for flow past cylindrical surfaces of arbitrary cross section when the undisturbed flow is supersonic. The theory accounts for effects arising from wall curvature and displacement of the boundary layer. A salient result of the theory is in the form of an analytical expression showing the dependence of surface heat transfer on the curvature and functions of curvature. The expressions are valid for arbitrary values of supersonic Mach numbers and ratios of wall to free stream temperature. The illustrative examples cover hyperbolic cylinders of different included angles between asymptotes for Mach numbers 1.5 and 2 and for ratios of wall to free stream temperature of 0.5 and 1. Results serve to demonstrate the effect of surface curvature on heat transfer. Examples clearly show the heating effect on the convex as well as on the concave side, which can be traced to the displacement effect of the boundary layer. Author (ESA)

N77-20037# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.
DEVELOPMENT OF A METHOD FOR CALCULATING SEPARATED FLOW AROUND AIRFOILS ACCOUNTING FOR PROFILE DRAG
Klaus Jacob 6 Aug. 1976 68 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-373)
(DLR-FB-76-36) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 33,80

A previously developed numerical method for theoretical prediction of airfoil lift in incompressible flow with rear separation is discussed. In this method the dead air region is simulated by an outflow region and the point of separation is determined iteratively by combining potential flow and boundary layer calculations. This method has been improved and extended within the last few years and gives pressure distributions and lift coefficients, which mostly agree well with experiments. If, however, the method is applied in present form to the calculation of profile drag, the calculated pressure drag is too small. The reason for this is investigated, and a better drag prediction is achieved by further improvement of the method. Author (ESA)

N77-20038# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
UNSTEADY PRESSURE MEASUREMENTS ON ROTOR BLADE TIPS WITH INCIDENCE IN INCOMPRESSIBLE FLOW
Hermann Triebstein 11 Aug. 1976 56 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-374)
(DLR-FB-76-42) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 28,70

The measurement of unsteady pressure on harmonically oscillating rotor blade tips in incompressible subsonic flow is dealt with. The measurements were made in a subsonic wind tunnel. The pressure was measured in five sections, allowing the three-dimensionality of the pressure distributions to be well observed. The flow speed was V = 45 m/s and the oscillation frequencies were f = 2, 4, and 6 Hz. The oscillation amplitudes ran from B = 1 to 3 deg, and the angles of attack were 0, 3, 6, 9, and 12 deg. Test facilities are described. Author (ESA)

N77-20039# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.
EFFECT OF BOUNDARY LAYER THICKNESS ON THE BASE PRESSURE IN TWO-DIMENSIONAL AND AXISYMMETRIC SUPERSONIC FLOW
Mauri Tanner 12 Aug. 1976 35 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-375)
(DLR-FB-76-43) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 18,60

Equations were developed for the prediction of the influence of the boundary layer thickness on the base pressure in two-dimensional and axisymmetric supersonic flow. Results show that, for an equal increment of the boundary layer thickness, the increase of the base pressure is smaller when the Mach number becomes greater. Author (ESA)

N77-20040# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
CALCULATION OF THE PRESSURE DISTRIBUTION ON HARMONICALLY OSCILLATING BODIES IN INCOMPRESSIBLE FLOW
Wolfgang Geissler 7 Sep. 1976 34 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-376)
(DLR-FB-76-48) Avail: NTIS HC A03; DFVLR, Cologne DM 17,90

A numerical method to calculate pressure distributions on thick axisymmetric bodies oscillating in pitching and plunging modes in a parallel flow is presented. A static angle of attack is taken into account for the unsteady calculations. It is not assumed that the amplitudes of oscillation are small compared to a characteristic body length. The method uses arbitrary source-sink distributions on the real body surface. The geometrical boundary condition and the Bernoulli equation for the calculation of pressures are nonlinearized. Besides determination of steady pressures and insteady pressures of the first harmonic it is shown that the method can be used to calculate the second and higher harmonics of the unsteady motion. Author (ESA)

N77-20041# Aeronautical Research Associates of Princeton, Inc., N. J.
PRESSURE DISTRIBUTION ON THE TRAILING EDGE OF AN AIRFOIL OSCILLATING IN A SHEAR LAYER Final Report, 1 Aug. 1975 - 31 Jan. 1976
John E. Yates Apr. 1976 56 p refs
(Contract F44620-75-C-0010; AF Proj. 9782)
(AD-A030887; ARAP-278; AFOSR-76-1076TR) Avail: NTIS HC A08/MF A01 CSCL 01/1

The problem of calculating the pressure distribution on an oscillating plate in a uniform parallel subsonic shear layer is idealized as a layer of fluid with constant velocity and temperature that are different from the free stream conditions. An approximate solution is developed for the case where the shear layer velocity defect (displacement thickness/shear layer thickness) is small. The results are valid for arbitrary length scale of the surface deflection. The problem is a model of an airfoil trailing edge immersed in a fully developed turbulent layer and wake. The lowest-order steady state solution is calculated for a linearly deflected flap and an exponential flap. The lowest-order unsteady exponential flap and the first-order steady state exponential flap are also solved in detail. The first-order pressure decreases as the square root of the distance from the trailing edge like the lowest-order result, and in accordance with a full application of

the Kutta condition. The amplitude of the correction involves the ration of the shear layer thickness to flap length. It is shown how the total lift on any section of the trailing edge of length L and flap length increases in the absence of a shear layer. An experiment to determine how the shear layer limits the growth of lift is suggested. GRA

N77-20042# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
AN EVALUATION OF A TWO-DIMENSIONAL POWER AUGMENTED WING IN GROUND EFFECT MODEL UNDER STATIC AND DYNAMIC FREESTREAM CONDITIONS Report, 1 Aug. 1975 - 1 Apr. 1976
B. S. Papadales, Jr. Jun. 1976 44 p refs
(ZF61412001)
(AD-A030750; DTNSRDC/ASED-353) Avail: NTIS HC A03/MF A01 CSCL 01/3

An evaluation was conducted to document the two-dimensional power augmented wing in ground effect phenomenon. Tests were conducted with a NACA 66-210 section wing and image with a two-dimensional thrustor (exhausting compressed air) aligned along the image plane. Results showed that power augmentation increased the lift of a wing in ground effect. The wing lift was observed to increase with increasing jet thrust. Also, the wing lift increased with increasing angle of attack and decreasing trailing edge gap. Lift coefficients as high as 2.40 were observed with a thrust coefficient of 0.48 at a trailing edge gap of 0.025c. Static augmentation ratios approaching 2.0 were observed with the same gap. The augmentation ratio increased linearly with the inverse of the thrust coefficient. The observed thrust recovery was very sensitive to the wing geometry. The largest thrust recovery was observed in the low thrust - low lift cases. Author (GRA)

N77-20043# Martin Marietta Labs., Baltimore, Md.
COMPUTATION OF THREE-DIMENSIONAL AERODYNAMIC FLOW Final Report, 1 Jul. 1970 - 30 Jun. 1976
K. C. Wang Aug. 1976 9 p refs
(Contract F44620-70-C-0085; AF Proj. 9749)
(AD-A031278; MML-TR-76-60C; AFOSR-76-1115TR) Avail: NTIS HC A02/MF A01 CSCL 01/1

This contract extended from July 1, 1970 to June 30, 1976. The purpose was to calculate numerically three-dimensional laminar boundary layers. During the contracting years, steady progress was made on this very difficult problem, for which there was initially only a minimal foundation. As a result, the basic mathematical problem has now been clarified and numerical methods and computational procedures established. Complete solutions revealed, for the first time, basic three-dimensional boundary layer structure in all details while new separation concepts were discovered. A series of journal publications and technical reports resulted. GRA

N77-20044# Notre Dame Univ., Ind.
ON THE ACCURACY OF FLECHETTES BY DYNAMIC WIND TUNNEL TESTS, BY THEORY AND ANALYSIS, AND BY ACTUAL FIRINGS
J. D. Nicolaides Philadelphia Franklin Arsenal Jan. 1975 363 p refs
(Contract DAAA25-71-C-0447; DA Proj. 1W6-62603-AH-78) (AD-B006505; FA-TT-75005) Avail: NTIS HC A16/MF A01 CSCL 19/4

Jump angles, design, Transitional ballistics, Fineness ratio The accuracy and dispersion of flechettes are investigated by: (1) an exploratory firing program, (2) a supersonic dynamic testing wind tunnel program, (3) development of a theory for jump and dispersion for computer computation and analysis, and (4) precision range firings at this arsenal. The exploratory firing program reveals the importance of fin and body damage, the blast region, and saboting. The dynamic wind tunnel program yields the static and dynamic aeroballistic stability coefficients on various flechette designs. The theory and analysis program has presented the effects of the initial launching conditions, the various stability coefficients, asymmetries, and has provided accuracy criteria. Lastly, the flechette firing range program provided a correlation between theory and experiment which clearly suggests that high accuracy and low dispersion in flechettes is possible when optimum aerodynamic design is coupled with good saboting and minimization of blast. GRA

N77-20045# Naval Postgraduate School, Monterey, Calif.
DESIGN AND WIND TUNNEL TESTING OF A SIZE SAMPLING IN SITU NET SYSTEM (SISSNET) M.S. Thesis
Robert Paul Mitchke Sep. 1976 95 p refs
(AD-A032376) Avail: NTIS HC A05/MF A01 CSCL 14/2

A number of plankton sampling devices have been designed and tested, and their physical properties (filtration, efficiency, filtration pressure drop, net filtration ratio and mesh approach speed) have been calculated and compared. The data necessary to make these calculations were collected by mounting 1/4 scale sampler models in a wind tunnel, the wind speed having been adjusted to that corresponding to a water speed of 40 m/min; wind speeds were measured at the samplers' mouths by a remote controlled hot-wire anemometer. Photographs were taken of the flow patterns through the use of a flow visualization system comprised of a liquid aerosol generator and tunnel injection system. A study of the photographs and the reduced data resulted in the discovery of an optimum design for a plankton collection system that is composed of a mouth reduction nose cone and two nets in series housed in a cylindrical casing. Author (GRA)

N77-20046# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL DETERMINATION OF THE AERODYNAMIC DRAG CHARACTERISTICS OF VARIABLE GEOMETRY RIGID BODIES M.S. Thesis
Larry David Pfitzenmaier Sep. 1976 60 p refs
(AD-A032369) Avail: NTIS HC A04/MF A01 CSCL 20/4

An investigation was made of the aerodynamic drag characteristics of two Variable Geometry Rigid Bodies (VGRB's). Results were obtained experimentally through the use of a low speed wind tunnel and an external wind-tunnel balance. Four wood models were tested representing two unique VGRB's in the full-volume and half-volume configurations. Results obtained with the smaller VGRB were compared to those obtained from an elongated body of revolution of equal length and volume. Author (GRA)

N77-19992# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany). Dept. of Aerodynamics.
SECTIONAL LOADS TECHNIQUE. PART 1: TEST TECHNIQUE. PART 2: TEST RESULTS
H. P. Franz and B. Ewald *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 16 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-19993# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Dept. of Aerodynamics.
PREDICTION OF AERODYNAMIC LOADINGS ON THE LEADING-EDGE SLATS OF THE FOKKER F 28 AIRLINER
In AGARD Prediction of Aerodynamic Loading Feb. 1977 13 p (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-19994# British Columbia Univ., Vancouver. Dept. of Mechanical Engineering.
PREDICTION OF AERODYNAMIC EFFECTS OF SPOILERS ON WINGS
G. V. Parkinson and P. Tam Doo *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 9 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-19995# Vought Corp., Dallas, Tex. Systems Div.
A TECHNIQUE FOR PREDICTING EXTERNAL STORE AERODYNAMIC LOADS
A. R. Rudnicki, Jr., E. G. Waggoner, Jr., and R. D. Gallagher *In* AGARD Prediction of Aerodynamic Loading Apr. 1977 13 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-19996# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Aerodynamik.
PREDICTION OF EXTERNAL STORES AND TIP-TANK

LOADS ON WING-FUSELAGE CONFIGURATIONS
S. R. Ahmed *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 18 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-19997# Saab-Scania, Linkoping (Sweden).
COMPARISON OF PREDICTED AERODYNAMIC LOADING WITH FLIGHT TEST RESULTS
Jan Kloos *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 7 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-19998# Systems Research Labs., Inc., Newport News, Va. RASA Division.
WING-VORTEX LIFT AT HIGH ANGLES OF ATTACK
Richard P. White, Jr. *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs (For primary document see N77-19990 11-01)
(Contract N00014-74-C-0091)
Avail: NTIS HC A15/MF A01

N77-19999# Lockheed-Georgia Co., Marietta.
VORTEX/JET/WING INTERACTION BY VISCOUS NUMERICAL ANALYSIS
R. M. Scruggs (Sybucon, Inc.), J. F. Nash (Sybucon, Inc.), and Charles J. Dixon *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs Sponsored by the Office of Naval Research (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20000# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISONS OF THEORETICAL AND EXPERIMENTAL PRESSURE DISTRIBUTIONS ON AN ARROW-WING CONFIGURATION AT SUBSONIC, TRANSONIC, AND SUPERSONIC SPEEDS
Marjorie E. Manro (Boeing Commercial Airplane Co., Seattle), Percy J. Bobbitt, and John T. Rogers (Boeing Commercial Airplane Co., Seattle) *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 14 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20001# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
THREE DIMENSIONAL SUPERSONIC FLOW ABOUT SLICED BODIES
Guido Colasurdo and Maurizio Pandolfi *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 7 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20002# National Aeronautical Establishment, Ottawa (Ontario).
A METHOD FOR ESTIMATING THE LOADING DISTRIBUTION ON LONG SLENDER BODIES OF REVOLUTION AT HIGH ANGLES OF ATTACK IN INCOMPRESSIBLE FLOW
E. Atraghji *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 20 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20003# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ASSESSMENT OF EXISTING ANALYTIC METHODS FOR PREDICTION OF HIGH ANGLE-OF-ATTACK LOADS ON DELTA WINGS AT SUPERSONIC SPEEDS
Emma Jean Landrum and James E. Townsend *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 7 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20004# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
ON THE CALCULATION OF THE PRESSURE DISTRIBUTION OF WING-BODY COMBINATIONS IN THE NON-LINEAR ANGLE OF ATTACK RANGE
Gregor Gregoriou *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 11 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20005# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany). Dept. of Aerodynamics.
PREDICTION METHOD FOR STEADY AERODYNAMIC LOADING ON AIRFOILS WITH SEPARATED TRANSONIC FLOW
P. G. Thiede *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20006# Aeronautical Research Inst. of Sweden, Bromma.
PRESSURE DISTRIBUTIONS FOR A SWEPT WING BODY CONFIGURATION OBTAINED FROM COUPLING TRANSONIC POTENTIAL FLOW CALCULATIONS AND BOUNDARY LAYER CALCULATIONS
Sven G. Hedman *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 9 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20007# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC LOADS NEAR CRANKS, APEXES, AND TIPS OF THIN, LIFTING WINGS IN INCOMPRESSIBLE FLOW
Richard T. Medan *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20008# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Theoretical Aerodynamics Group.
VORTEX LATTICE APPROACH FOR COMPUTING OVERALL FORCES ON V/STOL CONFIGURATIONS
Ciro W. Lucchi and Wolfgang Schmidt *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 8 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20010# Royal Aircraft Establishment, Farnborough (England). Dept. of Structures.
THE THEORETICAL PREDICTION OF STEADY AND UNSTEADY AERODYNAMIC LOADING ON ARBITRARY BODIES IN SUPERSONIC FLOW
D. L. Woodcock *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 21 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20014# General Dynamics/Convair, San Diego, Calif.
THEORY OF WING SPAN LOADING INSTABILITIES NEAR STALL
E. S. Levinsky *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 16 p refs (For primary document see N77-19990 11-01)
(Contract N62269-75-C-0356)
Avail: NTIS HC A15/MF A01

N77-20015# Air Force Academy, Colo.
DYNAMIC LOADING ON AN AIRFOIL DUE TO A GROWING SEPARATED REGION
James D. Lang and Michael S. Francis *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20016# Office National d'Etudes et de Recherches Aerospatiales, Modane (France).
PRESSURES OVER A SHARP-EDGED AIR INTAKE FUNCTIONING IN SUBSONIC FLOW AT REDUCED FLOWRATE
Gerard Laruelle and Paul Levart *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 12 p refs In FRENCH;

ENGLISH summary (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-20047*# Raytheon Co., Sudbury, Mass. Dept. of Electro-Optics.
AVIATION SAFETY RESEARCH AND TRANSPORTATION/HAZARD AVOIDANCE AND ELIMINATION Final Report
C. Sonnenschein, C. DiMarzio, D. Clippinger, and D. Toomey Aug. 1976 54 p ref
(Contract NAS8-30795)
(NASA-CR-150208; ER76-4220) Avail: NTIS HC A04/MF A01 CSCL 01C

Data collected by the Scanning Laser Doppler Velocimeter System (SLDVS) was analyzed to determine the feasibility of the SLDVS for monitoring aircraft wake vortices in an airport environment. Data were collected on atmospheric vortices and analyzed. Over 1600 landings were monitored at Kennedy International Airport and by the end of the test period 95 percent of the runs with large aircraft were producing usable results in real time. The transport was determined in real time and post analysis using algorithms which performed centroids on the highest amplitude in the thresholded spectrum. Making use of other parameters of the spectrum, vortex flow fields were studied along with the time histories of peak velocities and amplitudes. The post analysis of the data was accomplished with a CDC-6700 computer using several programs developed for LDV data analysis. Author

N77-20048# Transportation Systems Center, Cambridge, Mass.
AIRLINE DELAY TRENDS, 1973 - 1974: A STUDY OF BLOCK TIME DELAYS, GROUND AND AIRBORNE, FOR SCHEDULED AIR CARRIERS Annual Report, 1973 - 1974
Helen M. Condell, Seymour M. Horowitz, and Alan S. Kaprelian Jul. 1976 464 p
(AD-A032559/7; DOT-TSC-FAA-76-24; FAA-EM-76-8) Avail: NTIS HC A20/MF A01 CSCL 01/2

Estimates of block, airborne and ground delays for route segments flown by United States domestic scheduled airlines operating out of twenty large airports are presented. The data were determined from the CAB ER-586 Service Segment data base, which provides monthly operational times, both ground and airborne, for all route segments receiving scheduled air carrier service. The data are limited to the 325 route segments connecting the 20 airports included. Author

N77-20049# Dayton Univ. Research Inst., Ohio.
DAYTON AIRCRAFT CABIN FIRE MODEL VOLUME 1: BASIC MATHEMATICAL MODEL Final Report, Jul. 1974 - Mar. 1976
J. B. Reeves and C. D. MacArthur Jun. 1976 146 p refs 3 Vol.
(Contract DOT-FA74WA-3532)
(AD-A033682/6; FAA-RD-76-120-1-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 01/2

The mathematical model employs a technique of approximating the distribution of burning or smoldering regions on combustible materials by dividing the surface of the material into square area elements. The combustion behavior of a material is modeled by the allowing of the area elements to exist in one of seven discrete states. The four primary states are the following: virgin (the original, unignited condition), smoldering (nonflaming thermal degredation), flaming (burning with open flaming), or charred (burned-out or inert). The other three states are intermediate states in the transition to or from one of the four primary states. Fire ignition; flame spread; release of heat, smoke, and toxic combustion products; and the eventual extinction of a fire are all predicted by specifying times of transition between the four primary states and by specifying flame spread rates. Author

N77-20050# Dayton Univ. Research Inst., Ohio.
DAYTON AIRCRAFT CABIN FIRE MODEL VOLUME 2: LABORATORY TEST PROGRAM Final Report, Jul. 1974 - Mar. 1976
Jerry B. Reeves Jun. 1976 271 p refs 3 Vol.
(Contract DOT-FA74WA-3532)
(AD-A033683/4; FAA-RD-76-120-2-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 01/2

A laboratory test program was conducted in support of the model development. Various flammability and combustion toxicity properties were measured for several wide-body cabin materials. The measurements were made using the OSU combustion analyzer, the NBS smoke chamber, and the Boeing burn-through apparatus. The test procedures, the test results, the analysis of the test data, and the development of a set of material properties input data for the cabin fire simulation program are described. Author

N77-20051# Dayton Univ. Research Inst., Ohio.
DAYTON AIRCRAFT CABIN FIRE MODEL VOLUME 3: COMPUTER PROGRAM USER'S GUIDE Final Report, Jul. 1974 - Mar. 1976
Peter M. Kahut Jun. 1976 255 p 3 Vol.
(Contract DOT-FA74WA-3532)
(AD-A033989/5; FAA-RD-76-120-3-Vol-3) Avail: NTIS HC A12/MF A01 CSCL 01/2

A basic mathematical model and computer simulation program were developed to assess the smoke and toxic gas emissions resulting from the burning of cabin interior materials of a wide-body transport aircraft in a full-scale fire. The simulation is based on laboratory test data on the cabin materials. The computer simulation program includes instructions for input data preparation, sample input and output, basic definitions concerning the simulation program and mathematical model, and a brief description of the program structure. Author

N77-20052# Lockheed-California Co., Burbank.
A METHOD OF ANALYSIS FOR GENERAL AVIATION AIRPLANE STRUCTURAL CRASHWORTHINESS Final Report, Jun. 1975 - Sep. 1976
Gil Wittlin and Max A. Gamon Sep. 1976 323 p refs Prepared in cooperation with the Cessna Aircraft Co., Wichita, Kans.
(Contract DOT-FA75WA-3707)
(AD-A032415/2; LR-27698; FAA-RD-76-123) Avail: NTIS HC A14/MF A01 CSCL 01/2

A review and evaluation of 8491 accidents obtained from National Transportation Safety Board (NTSB) tapes are presented. Eighteen accident cases from the FAA Civil Aeromedical Institute (CAMI) files are discussed. The performance parameters and structural design characteristics associated with 61 general aviation airplane models are used to establish several airplane categories for light fixed-wing aircraft. An accident data computer program, developed by the Cessna Aircraft Company, is presented. The requirements for performing computerized crash analysis of general aviation airplanes during probable accident conditions are described. Program KRASH, as modified to meet the requirements of the general aviation industry, is described and assessed with the use of two sets of crash test (stall-spin and overturn) data for a single engine high wing and a single engine low wing airplane. The mathematical models and the comparison of analysis and test results for both airplanes and accidents are presented. Author

N77-20053# National Aviation Facilities Experimental Center, Atlantic City, N. J.
AIRCRAFT CABIN COMPARTMENTATION CONCEPTS FOR IMPROVING POSTCRASH FIRE SAFETY Final Report, Jan. 1975 - Jan. 1976
Richard Hill, Paul N. Boris, and George R. Johnson Oct. 1976 73 p refs
(FAA Proj. 181-521-000)
(AD-A033051/4; FAA-NA-76-12; FAA-RD-76-131) Avail: NTIS HC A04/MF A01 CSCL 01/3

Aircraft cabin compartmentation was investigated as a means

of increasing escape time for passengers during a postcrash cabin fire. The size and configuration of various partitions and/or curtains were investigated to determine their effectiveness in providing protection from a cabin fire by limiting the spread of heat, smoke, carbon monoxide (CO), and the depletion of oxygen from the vicinity of the fire to other areas of the cabin. The results of these tests indicate that a tightly sealed partition and/or curtain afforded the greatest protection from the spread of a given amount of heat, CO, and depletion of oxygen. The results also indicated that the use of compartmentation can adversely affect the intensity of a fire in an unclosed area, creating more products of combustion. Except for a limited number of cases, the amount of protection provided by the partition exceeded the increase in fire intensity. Author

N77-20054# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

STATISTICAL STUDIES ON DYNAMIC ZONES OF PROTECTION DURING HORIZONTAL EVASIVE MANEUVERS

Otto Weber 23 Sep. 1976 48 p refs In GERMAN; ENGLISH summary

(DLR-FB-76-51) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 22.80

Theoretical studies and arithmetical simulations in the field of dynamic zones of protection during horizontal evasive maneuvers for avoiding midair collisions are dealt with. The airborne navigation system consists of a VOR/DME receiving equipment and a simple RNAV unit. During a flight on a VOR radial the pilot is requested by a controller to make a track leg change to an impromptu waypoint as soon as a selected distance is indicated on the DME instrument. The zones of protection at the end of the evasive turn and during the flight to the waypoint are symbolized by means of 95% ellipses. The influences of the VOR/DME errors, the flight technical errors, and the environmental conditions on the position, the shape, and the size of the ellipses were investigated analytically and by means of numerous arithmetical simulations using the Monte Carlo method. The zones of protection and selected flight paths are represented in many graphs. The methods and results for collision avoidance can also be applied to some problems of 3-D or 4-D RNAV and of air traffic flow control. Author (ESA)

N77-20055# National Transportation Safety Board, Washington, D. C. Bureau of Aviation Safety.

FLIGHT CREW COORDINATION PROCEDURES IN AIR CARRIER INSTRUMENT LANDING SYSTEM APPROACH ACCIDENTS

18 Aug. 1976 36 p ref

(PB-258720/2; NTSB-AAS-76-5) Avail: NTIS HC A03/MF A01 CSCL 01B

Air carrier ILS (Instrument Landing System) accidents and incidents which occurred from 1970 through 1975 are analyzed. Air carrier flightcrew coordination procedures, the variations between the procedures of different carriers, and their involvement in ILS approach accidents are discussed. GRA

N77-20056# Federal Aviation Administration, Washington, D.C. Office of Management Systems.

THE 1975 GENERAL AVIATION ACTIVITY SURVEY Summary Report

Shung-Chai Huang Sep. 1976 70 p refs

(AD-A032259) Avail: NTIS HC A04/MF A01 CSCL 01/2

The Federal Aviation Administration and the Civil Air Patrol conducted this general aviation activity survey as a joint effort on August 23 and 26, 1975. The survey produced a comprehensive data base. It is useful in describing general aviation aircraft and pilot profiles, in examining the relationship between aircraft use, ownership, pilot certificate, pilot age and activity and in estimating airport traffic as well as fuel consumption. Author (GRA)

N77-20057# Transportation Research Board, Washington, D.C.

AIRPORT AND AIR TRANSPORT PLANNING

David Rubin 1976 49 p refs

(PB-259413/3; TRB/TRR-588; ISBN-0-309-02554-0) Avail: NTIS HC A03/MF A01 CSCL 01B

Air passenger forecasting in a multiairport region is discussed along with interactive computing techniques in airport master planning. Staging runway expansion by dynamic programming for Washington National and Dulles International airports is introduced. Passenger behavior and design of airport terminals and a way to survey pedestrian traffic in airport terminals by use of time stamping cards is studied. Economic impact associated with development of an airport industrial complex, and scheduling analysis model of rural commuter air service are reported. GRA

N77-20058# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.

DEVELOPMENT OF A DOPPLER RADAR TECHNIQUE FOR THE DETECTION OF BIRD HAZARDS TO AIRCRAFT Final Report, 19 May 1972 - 12 Dec. 1975

John L. Green and Ben B. Balsey Tyndall AFB, Fla. AFCEC 12 Dec. 1975 93 p refs

(AF Proj. 2103)

(AD-A030410; AFCEC-TR-76-17) Avail: NTIS HC A05/MF A01 CSCL 17/9

The purpose of this research project was to develop a radar technique to detect the presence of flying birds potentially hazardous to aircraft near airport runways; to distinguish them from other radar targets; to estimate the size and number of birds in order to assess the hazard. The motions of a bird in flight are characterized by a distinctive velocity spectrum that can be detected by radar. These 'aural signatures' were identified by Doppler technique and verified by visual sightings. This report provides a description of the analysis techniques, compares range-gated to nonrange-gated systems and also conventional and Doppler radars. A discussion concerning modification of a typical system to a Doppler system is included. A method of determining the actual number of birds in the target volume is discussed. The report also includes a scene-by-scene description of a film presentation made to more fully quantify the Doppler technique. Author (GRA)

N77-20059# Naval Postgraduate School, Monterey, Calif.

FACTORS INVOLVED IN THE VARIABILITY OF MONTHLY MAJOR AIRCRAFT ACCIDENT RATES Technical Report, Apr. - Jul. 1976

Gary K. Poock Jul. 1976 17 p refs

(AD-A031840; NPS-55PK76071) Avail: NTIS HC A02/MF A01 CSCL 01/2

Results are presented showing the development of regression equations to help determine human and/or aircraft variables which appear to account for the variability in monthly major aircraft accident rates. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N77-20060 British Library Lending Div., Boston Spa (England).

EXPERIMENTS WITH THE RUNWAY VISUAL RANGE CONVERTER UNDER DIFFERENT CONDITIONS OF BACKGROUND LUMINANCE (BL)

R. F. Cannemeijer and J. P. deJongh 1976 23 p refs Transl. into ENGLISH of scientific report WR-76-3 of the Royal Netherlands Meteorological Institute

(BLL-M-24798-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The extent the electronic apparatus operates correctly, i.e. to what extent the apparatus agrees with the tables which give a value for the RVR(runway visual range)were examined. Recommendations were made regarding the network of BL meters to be installed at Schipol. The RVR converter was checked for transmission percentages below 60%. The curves for twilight and daytime (normal) satisfy the specifications entirely. Regarding the nocturnal curve, the deriations were more than 100 m RVR

but less than 150 m RVR for transmission percentages between 25% and 40% (for RVR values between 1000 and 1600 m).
Author

N77-20061*# Ohio Univ., Athens. Avionics Engineering Center.
MINI-L LORAN-C RECEIVER
R. W. Burhans Mar. 1977 34 p refs
(Grant NGR-36-009-017)
(NASA-CR-152624; TM-48) Avail: NTIS HC A03/MF A01 CSCL 17G

A brief description of the Loran-C system is presented with a suggested receiver based on a standard AM-FM integrated circuit chip. Construction details of the Mini-L Loran-C prototype front-end are considered. The Mini-L system was bench tested for approximately 500 hours under a variety of reception conditions. The Mini-L concept combined with a microprocessor system is a promising approach to the development of truly low-cost Loran-C receivers for the marine and airborne user.
Author

N77-20062# National Aviation Facilities Experimental Center, Atlantic City, N. J.
A COMPENDIUM OF NAS ENROUTE SYSTEM PERFORMANCE, ANALYSIS, AND MODELING DOCUMENTATION RELATIVE TO THE MODEL A3D2 ENROUTE OPERATIONAL SYSTEM Final Report, Jan. 1969 - Jun. 1976
Mae Ohman and Robert F. Irwin Sep. 1976 42 p
(AD-A032464/0; FAA-RD-76-175) Avail: NTIS HC A03/MF A01 CSCL 17/7

The documents in this compendium are in the form of design concepts, design specifications, performance memorandums, or the response to FAA requested studies that may, or may not have been implemented into the EnRoute Model A3d2 Operational Software Program.
Author

N77-20063# Federal Aviation Administration, Washington, D.C.
AN OVERVIEW OF ENROUTE RADIO NAVIGATION SERVICES FOR CIVIL AVIATION Final Report
Carlo Yulo Aug. 1976 22 p
(AD-A032497/0; FAA-RD-76-187) Avail: NTIS HC A02/MF A01 CSCL 17/7

An overview of radio aids to navigation for civil aviation, and outlines of engineering and development efforts that are responsive both to the needs of the aviation community and to the budgetary concerns of Congress are presented.
Author

N77-20064# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
AN NBS PHASE NOISE MEASUREMENT SYSTEM BUILT FOR FREQUENCY DOMAIN MEASUREMENTS ASSOCIATED WITH THE GLOBAL POSITIONING SYSTEM
S. R. Stein Aug. 1976 29 p refs
(PB-258327/6; NBSIR-76-846) Avail: NTIS HC A03/MF A01 CSCL 17G

A self-contained system is described which was constructed to perform phase noise measurements for the first phase of the Global Positioning System (GPS). It is capable of evaluating a pair of similar oscillators or a single oscillator and a frequency synthesizer using the phase-lock technique. Three features were included to simplify the operation of the instrument: internal circuitry automatically detects an out of lock condition; an optimized second order phase lock loop reduces phase error by a factor of 100,000 over a first order loop; selection of operating mode is made by a single front panel switch.
GRA

N77-20065# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
REVIEW OF THE GUIDANCE PROVIDED FOR AIRCRAFT RECOVERY UNDER INSTRUMENT FLYING CONDITIONS M.S. Thesis
David William Livingston Sep. 1976 112 p refs
(AD-A032201; GSM/SM/76S-15) Avail: NTIS HC A06/MF A01 CSCL 01/2

Aircraft recovery under instrument conditions entails inherent risks. Many commanders, in their attempts to conserve and preserve limited and costly resources, have taken steps to reduce the risk involved. Air Force has expended considerable effort to devise and implement a standardized recovery procedure for instrument conditions. Each major command has the option to modify the Air Force guidance, making it more restrictive for its respective command. In exercising this option the major commands have arrived at guidance which ranges from no action to the establishment of a new set of criteria superimposed over the Air Force guidance. This thesis documents the guidance provided by Air Force and eight different major commands. It further presents the rationale provided by the major commands in support of its actions. The analysis of the actions taken and the rationale, plus the analysis of relevant secondary issues, were used in formulating proposed major command guidance. It is recommended that the Air Force review its directives to correct the known deficiencies and to limit the major commands to modifying only the published weather minimums. Each major command should reevaluate its procedures to insure it achieves command established objectives and is compatible with the Air Force guidance.
Author (GRA)

N77-20066# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
FLIGHT TEST DEMONSTRATION OF AUTOMATIC LANDINGS BASED ON MICROWAVE LANDING SYSTEM GUIDANCE Final Report, Mar. - May 1976
Don Eastman and P. Clough Aug. 1976 54 p refs
(AD-A031777; AFFDL-TR-76-105) Avail: NTIS HC A04/MF A01 CSCL 01/4

This report describes the USAF participation in the gathering of data for the United States submission to the International Civil Aviation Organization of a Non-Visual Precision Approach and Landing System for International Aviation. The report contains data on Time Referenced Scanning Beam Microwave Landing System accuracy, as recorded on the test aircraft during automatic approaches and landings. The report contains information on aircraft performance and pilot acceptance for performing automatic MLS instrument approaches and landings. The USAF modified T-39 aircraft was capable of flying fully coupled and automatic curved and segmented approaches through landing using TRSB MLS data. The purpose of the flight testing was to demonstrate an inherent TRSB MLS capability rather than to provide a great amount of MLS accuracy or performance data.
Author (GRA)

N77-20067# Facility Checking Squadron (1866th) (AFCS), Richards-Gebaur AFB, Mo.
COMMUNICATIONS STATION EVALUATION REPORT, HOWARD AFB, CANAL ZONE Final Report, 31 Mar. - 15 Apr. 1976
Jimmy D. Buford 11 Aug. 1976 73 p refs
(AD-A030107; Rept-76/66C-68) Avail: NTIS HC A04/MF A01 CSCL 17/9

A combined Traffic Control and Landing Systems (TRACALS) station evaluation of the AN/MPN-13A radar and the communications system was performed at Howard AFB, C. Z., 31 Mar 76 through 15 Apr 76. The purpose of the evaluation was to define the capabilites and limitations of the air traffic control facilites. This report deals with only the ground/air/ground communication portion of the evaluation. Included in this report are results and analysis of equipment checks, loop test line level diagrams for the GCA and control tower systems, line of sight coverage data, analysis of airborne measurements, and plots of UHF radiation patterns. In addition, there is included a discussion of the RIVET SWITCH receiver output levels, receiver squelch circuit adjustments, and RIVET SWITCH receiver transmitter modulation metering circuits. The data and diagrams presented in this report can be used as a guide for anticipated performance of the Communication system at Howard AFB until there is an addition, deletion, relocation of equipment, or change in horizon profile which would affect the system. The principles presented in this report are valid for other locations using the same communications equipment.
Author (GRA)

N77-20068# Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio. Industrial Engineering Support Div.
AGMC LIFE CYCLE COST MODEL, AN ACCOUNTING MODEL FOR INERTIAL NAVIGATION SYSTEMS Final Report
Richard W. Rogge 2 Aug. 1976 70 p refs
(AD-A030069; AGMC/XRXE-76-3) Avail: NTIS

HC A04/MF A01 CSCL 17/7

This report described the accounting Model developed by AGMC to evaluate the Life Cycle Costs of Inertial Navigation Systems. However, it is a general purpose Model and may be tailored for other than Inertial Navigation Systems by simply re-naming parameters as applicable. The purpose of the Model is to provide a method to compare two or more types of systems, or maintenance options on the same system. It provides a simplified approach to modeling costs, as the number of different types of input data required is relatively small. This Model has the capability of isolating and identifying start-up costs and recurring costs. It allows analysis through three indenture levels: Line Replaceable Units (LRU), Shop Replaceable Units (SRU), and Depot Replaceable Units (DRU). Included in this report are a description of parameters, Model equations, a sample run print out and a program listing of the Model. Author (GRA)

N77-20069# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
OPERATING FREQUENCIES FOR THE NAVSTAR/GLOBAL POSITIONING SYSTEM Final Report
Frank E. Butterfield 30 Jul. 1976 49 p refs
(Contract F04701-75-C-0076)
(AD-A030164; TR-0076(6474-01)-1; SAMSO-TR-76-197) Avail: NTIS HC A03/MF A01 CSCL 17/7

A new aeronautical radionavigation system is being established to provide accurate worldwide navigation. The system employs transmitters mounted in earth orbiting satellites. The choice of operating frequencies for this system is limited by system accuracy on the one hand and satellite cost on the other. The technical basis for frequency choices is given along with the regulatory circumstances, the system options which should be retained, and an explanation of radiated power requirements. Author (GRA)

N77-20070# Mitre Corp., McLean, Va.
THE TCA/ERS STAGE 3 COSTS STUDY
M. A. Ditmore and R. A. Rucker Jul. 1976 66 p refs
(Contract DOT-FA70WA-2448)
(AD-A029975; MTR-7266; FAA-EM-76-7) Avail: NTIS HC A04/MF A01 CSCL 17/7

Terminal Control Areas (TCAs) and Expanded Radar Services (ERS), Stage III, should be very effective in reducing midair collision risks in the busier terminal areas, by converting VFR flights unknown to ATC into known participants in the traffic control process. The report examines the extent to which VFR flights have participated and finds an average of 28%. The costs of providing these services are shown to be predominately labor costs (pro-rated investment costs are estimated to be less than one-half of one year's pro-rated labor costs). GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-20071# Aeronautical Research Labs., Melbourne (Australia).
AIRCRAFT STUCTURAL LIFE MONITORING AND THE PROBLEM OF CORROSION
L. M. Bland Aug. 1976 40 p refs Proposed for presentation at ARL Symp. on Aircraft Structural Fatigue
(ARL/Mat-TM-365; ICAF-907) Avail: NTIS HC A03/MF A01

The principles of the fatigue design of structures and of their maintenance, are considered and the relevance of the chemical and physical environment is discussed. The place of environment and corrosion monitoring is identified and the importance of nondestructive inspection is assessed. Limitations of available inspection methods are indicated. Author

N77-20072# Aeronautical Research Labs., Melbourne (Australia).
FIBRE COMPOSITE REINFORCEMENT OF CRACKED AIRCRAFT STRUCTURES
A. A. Baker and M. M. Hutchison Aug. 1976 50 p refs To be presented at the A. R. L. Symp. on Aircraft Structural Fatigue
(ARL/Mat-TM-366) Avail: NTIS HC A03/MF A01

The fatigue performance of a range of commercially available adhesive materials was examined to enable the selection of an adhesive system suitable for bonding of fibre composite reinforcements to cracked aircraft structures. Small constant stress cantilever 7075-T6 aluminium alloy fatigue specimens were used to evaluate the characteristics of the adhesives and also to examine the feasibility of using fibre composites to control crack propagation. The adhesive selected for the repair application required curing at 130 C which, due to the low thermal expansion of the composite, induced residual textile stresses in the aluminum at room temperature. Wedge-loaded, precracked stress-corrosion specimens were used to show that these internal stresses do not significantly limit the practical usefulness of the proposed repair schemes. Practical aircraft repairs are described which are currently being evaluated under operating conditions. Author

N77-20073# Aeronautical Research Labs., Melbourne (Australia).
FLIGHT LOAD RESEARCH AT ARL
A. K. Patterson and C. K. Rider Aug. 1976 14 p refs Proposed for presentation at ARL Symp. on Aircraft Structural Fatigue
(ARL/Struc-TM-252; ICAF-903) Avail: NTIS HC A03/MF A01

The need to establish valid flight load statistics for fatigue life estimation was obtained. The flight aircraft was reviewed. Progress in the two activities was not uniform, with significant advances being closely related to technological developments. Author

N77-20074# Aeronautical Research Labs., Melbourne (Australia).
AIRCRAFT STRUCTURAL RELIABILITY AND RISK THEORY: A REVIEW
F. H. Hooke Aug. 1976 57 p refs Proposed for presentation at ARL Symp. on Aircraft Structural Fatigue
(ARL/Struc-TM-253; ICAF-904) Avail: NTIS HC A04/MF A01

The structural reliability and probability of failure during the lifetime was evaluated based upon load history data and strength decay properties known or attributed to the structures. The method dispenses with arbitrary scatter factors, though equivalent scatter factors are determined from the relation between reliability and age if desired. The fatigue sensitivity of a structure was characterized by the relationship of fatigue failure risk to static ultimate failure risk. Reliability of reliability estimates is examined, and is usually limited by sampling problems and arbitrary judgments concerning the attribution of properties to the population in question. The estimates are compared with those derived by semi-probabilistic or limit analysis methods. Author

N77-20075# Aeronautical Research Labs., Melbourne (Australia).
CURRENT DEVELOPMENTS IN THE LIFE OF AIRCRAFT STRUCTURES
A. O. Payne Sep. 1976 32 p refs Proposed for presentation at ARL Symp. on Aircraft Structural Fatigue
(ARL/Struc-TM-256; ICAF-905) Avail: NTIS HC A03/MF A01

Current procedures for fatigue design and fatigue life estimation, substantiation and monitoring of aircraft structures are reviewed. Major gaps in the present state of knowledge are identified and research directed towards filling these gaps is discussed. Author

N77-20076*# Mississippi State Univ., Mississippi State.
FLIGHT TEST EVALUATION OF A METHOD TO DETERMINE THE LEVEL FLIGHT PERFORMANCE OF A PROPELLER-DRIVEN AIRCRAFT
Phillip G. Bridges (McDonnell Douglas Corp., St. Louis, Mo.), Ernest J. Cross, Jr. (Miss. State Univ., Miss. State, Miss.), and Donald W. Boatwright (Miss. State Univ., Miss. State, Miss.) 1977 28 p refs Presented at the Business Aircraft Meeting, Century 2, Wichita, 29 Mar. - 1 Apr. 1971; sponsored by the Sec. of Automotive Engineers
(Grant NsG-1231)
(NASA-CR-149889) Avail: NTIS HC A03/MF A01 CSCL 01C

The overall drag of the aircraft is expressed in terms of the measured increment of power required to overcome a corresponding known increment of drag, which is generated by a towed drogue. The simplest form of the governing equations, D = delta D SHP/delta SHP, is such that all of the parameters on the right side of the equation can be measured in flight. An evaluation of the governing equations has been performed using data generated by flight test of a Beechcraft T-34B. The simplicity of this technique and its proven applicability to sailplanes and small aircraft is well known. However, the method fails to account for airframe-propulsion system. Author

N77-20077*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LOW-SPEED POWER EFFECTS ON ADVANCED FIGHTER CONFIGURATIONS WITH TWO-DIMENSIONAL DEFLECTED THRUST

John W. Paulson, Jr., James L. Thomas, and Long P. Yip Feb. 1977 21 p refs

(NASA-TM-X-74010) Avail: NTIS HC A02/MF A01 CSCL 01C

Wind-tunnel studies at the Langley Research Center have shown that significant increases in maximum lift coefficient and stability and decreases in drag due to lift are obtained when two-dimensional vectored thrust is used in conjuction with a close-coupled canard. The configuration tested was somewhat above the theoretical minimum drag due to lift because of the sharp leading edge on the biconvex airfoil used on the wing and canard. An effort to design a new configuration which will approach the minimum drag due to lift while maintaining high-lift configurations was completed. The resulting model will incorporate a realistic planform, airfoil section, and twist for a transonic maneuvering configuration. Author

N77-20078*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLIGHT-TEST MEASUREMENT OF THE NOISE REDUCTION OF A JET TRANSPORT DELAYED FLAP APPROACH PROCEDURE

John D. Foster and Paul L. Lasagna (NASA Dryden Flight Research Center) Dec. 1976 28 p refs

(NASA-TM-X-73172; A-6775) Avail: NTIS HC A03/MF A01 CSCL 01C

A delayed flap approach procedure was flight tested using the NASA CV-990 airplane to measure and analyze the noise produced beneath the flight path. Three other types of landing approaches were also flight tested to provide a comparison of the noise reduction benefits to the delayed flap approach. The conventional type of approach was used as a baseline to compare the effectiveness of the other approaches. The decelerating approach is a variation of the delayed flap approach. A detailed comparison of the ground perceived noise generated during the approaches is presented. For this comparison, the measured noise data were normalized to compensate for variations in aircraft weight and winds that occurred during the flight tests. The data show that the reduced flap approach offers some noise reduction, while the delayed flap and decelerating approaches offer significant noise reductions over the conventional approach. Author

N77-20079*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

BEHAVIOR OF AIRCRAFT ANTISKID BRAKING SYSTEMS ON DRY AND WET RUNWAY SURFACES - A VELOCITY-RATE-CONTROLLED, PRESSURE-BIAS-MODULATED SYSTEM

Sandy M. Stubbs and John A. Tanner Washington Dec. 1976 131 p refs

(NASA-TN-D-8332; L-10976) Avail: NTIS HC A07/MF A01 CSCL 01C

During maximum braking the average ratio of drag-force friction coefficient developed by the antiskid system to maximum drag-force friction coefficient available at the tire/runway interface was higher on dry surfaces than on wet surfaces. The gross stopping power generated by the brake system on the dry surface was more than twice that obtained on the wet surfaces. With maximum braking applied, the average ratio of side-force friction coefficient developed by the tire under antiskid control to maximum side-force friction available at the tire/runway interface of a free-rolling yawed tire was shown to decrease with increasing yaw angle. Braking reduced the side-force friction coefficient on a dry surface by 75 percent as the wheel slip ratio was increased to 0.3; on a flooded surface the coefficient dropped to near zero for the same slip ratio. Locked wheel skids were observed when the tire encountered a runway surface transition from dry to flooded, due in part to the response time required for the system to sense abrupt changes in the runway friction; however, the antiskid system quickly responded by reducing brake pressure and cycling normally during the remainder of the run on the flooded surface. Author

N77-20080*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE EFFECT OF VISUAL-MOTION TIME-DELAYS ON PILOT PERFORMANCE IN A SIMULATED PURSUIT TRACKING TASK

G. Kimball Miller, Jr. and Donald R. Riley Washington Mar. 1977 99 p refs

(NASA-TN-D-8364; L-11062) Avail: NTIS HC A05/MF A01 CSCL 05E

An experimental study was made to determine the effect on pilot performance of time delays in the visual and motion feedback loops of a simulated pursuit tracking task. Three major interrelated factors were identified: task difficulty either in the form of airplane handling qualities or target frequency, the amount and type of motion cues, and time delay itself. In general, the greater the task difficulty, the smaller the time delay that could exist without degrading pilot performance. Conversely, the greater the motion fidelity, the greater the time delay that could be tolerated. The effect of motion was, however, pilot dependent. Author

N77-20081*# Chrysler Corp., New Orleans, La.

RESULTS OF A CARRIER AIRCRAFT (MODEL AX13191-4) VERIFICATION TEST IN THE BOEING TRANSONIC WIND TUNNEL USING A 0.03-SCALE 747 CAM/ORBITER MODEL 45-0 (CA6), VOLUME 1

Oct. 1976 624 p refs 2 Vol.

(Contract NAS9-13247)

(NASA-CR-147630; DMS-DR-2262-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 01C

Force and moment data were obtained on each vehicle both mated and separated. The investigation included the effects of orbiter incidence, orbiter tail cone, orbiter strut fairings, elevon, and body flap settings. Analysis of the data indicated the 747 is suitable as a carrier of the orbiter in both the ALT launch and ferry mode. The effect of configuration changes on drag and stability was determined. Author

N77-20082*# Chrysler Corp., New Orleans, La. Space Div.

RESULTS OF A CARRIER AIRCRAFT (MODEL AX13191-3) VERIFICATION TEST IN THE BOEING TRANSONIC WIND TUNNEL USING A 0.03-SCALE 747 CAM/ORBITER MODEL 45-0 (CA6), VOLUME 2

Oct. 1976 965 p refs 2 Vol.

(Contract NAS9-13247)

(NASA-CR-147631; DMS-DR-2262-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 01C

For abstract, see N77-20081.

N77-20083# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

FLIGHTDECK ILLUMINATION FOR HELICOPTERS

H. J. Leebeek and E. Ellens 1976 9 p In DUTCH; ENGLISH summary

(Contract A76/KM/059)

(IZF-1976-15; TDCK-68485) Avail: NTIS HC A02/MF A01

A new illumination method for helicopter decks used on Royal Dutch Navy vessels using flood light fittings is presented. In order to have an optimal homogeneous illumination on deck and to meet the requirement that no light reach the sea surface, the lighting fittings have to be delicately directed and screened off. A simple and inexpensive method to achieve this is described. Author (ESA)

N77-20084# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

A-4F BLUE ANGEL FLIGHT USAGE DATA, 1974-1975 Final Report, 1974 - 1975
K. I. Leikach and G. A. Bohannon 30 Jun. 1976 97 p refs
(AD-A032351; NADC-76276-30) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report provides flight usage data collected and used to calculate/monitor structural fatigue life expended on individual Blue Angel aircraft and presents flight environmental data which were used to establish full scale fatigue test requirements. A total of 4386.0 hours of counting accelerometer data (recorded on a flight by flight basis) and 436.0 hours of oscillograph data (normal acceleration, airspeed, and altitude data) were processed and are presented. Load rate spectra developed from this data have application in fatigue life calculations/testing and in the identification of extreme or excessive trends detrimental to prolonging fatigue life. GRA

N77-20085# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
F-18 INTERIOR LIGHTING ANALYSIS: RED VERSUS WHITE Phase Report
Lloyd Hitchcock, Jr. 2 Sep. 1976 30 p refs
(AD-A031695; NADC-76177-40) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report presents a brief summary of the literature relevant to the selection of cockpit lighting coloration for the F-18 (and similar) aircraft. The generally accepted preference for red lighting is questioned with the ultimate choice of color found to rest upon a mission requirement for maximum sensitivity for light detection. Author (GRA)

N77-20086# Kearney (A. T.) and Co., Inc., Chicago, Ill. Caywood-Schiller Div.
PRELIMINARY STUDY OF COMPUTER MODELING OF THE DYNAMIC FUEL CONDITIONS IN WEAPON SYSTEM VULNERABILITY ANALYSIS Final Report, 1 Jul. 1973 - 31 Mar. 1974
M. A. Dloogatch, W. R. Doane, and P. C. Hewett Sep. 1976 72 p
(Contract F33615-73-C-2078)
(AD-A031489; AFAPL-TR-74-92; JTCG/AS-74-V-011) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report presents the results of a study to develop a dynamic model of the vulnerability of an aircraft fuel system to the threats posed by hostile weapons. A Monte Carlo model was developed to calculate the probability of hit along segments of a specified flight profile at each point where a specified weapon system could pose a threat to the fuel system. An Air Force developed computer model (Well-Stirred Fuel Tank Model) is used to compute fuel state in each fuel tank under study at increments along the flight path. These are used as inputs to the Monte Carlo model. Given that a hit takes place, the probable trajectories (liquid-air, liquid-liquid, and air-air) are calculated, and the probabilities of lethal outcomes (explosion, internal fire, external fire, leak) are computed. The model ranks the most likely events, and a hazard index is generated which portrays the most important threats to the fuel system on the specified flight path. The resulting model gives an improved measure of the impact of fuel state on the vulnerability of a fuel system on aircraft vulnerability. It does not incorporate consideration of the effects of fuel slosh, vibration, or vent geometry. Further refinement and development is recommended. GRA

N77-20087# Boeing Vertol Co., Philadelphia, Pa.
HEAVY LIFT HELICOPTER, CARGO HANDLING ATC PROGRAM. VOLUME 3: RESULTS OF TESTS, INSPECTIONS, AND EVALUATIONS
R. Campbell, J. Shefrin, L. Simpson, B. J. Solak, and G. Wilson Oct. 1976 496 p
(Contract DAAJ01-71-C-0840)
(AD-A032129; D301-10324-1-Vol-3; USAAMRDL-TR-74-97C) Avail: NTIS HC A21/MF A01 CSCL 01/3

This report formally documents the efforts and results of the cargo handling system segment of the Heavy Lift Helicopter (HLH) Advanced Technology Component (ATC) development program. The HLH Cargo Handling system tested and evaluated herein consists of: tandem pneumatically driven hoists which provide high speed inflight stability for externally slung cargo, with pitch attitude control and a long reach cargo acquisition and delivery capability; a visual augmentation system to assist the load controlling crewman in acquiring cargo under conditions of darkness and visual obscuration, and a static electricity discharge system to protect ground cargo handlers from shock hazards. This volume contains descriptions and results of: design support and development tests, which assisted in finalizing and substantiating the designs for the cargo handling components; the integrated test rig program, which demonstrated feasibility and achievement of design, functional, performance and reliability characteristics; and the disassembly and teardown inspection of selected components utilized on the integrated test rig. GRA

N77-20088# Army Medical Intelligence and Information Agency, Washington, D.C.
PROTOTYPE INTERNAL RESCUE HOIST FOR UH-ID, SERIES V22.228.400, PROVISIONAL TECHNICAL DESCRIPTION
2 Nov. 1976 64 p refs Transl. into ENGLISH of unidentified German report, 1 Dec. 1972
(AD-A032147; USAMIIA-K-6697) Avail: NTIS HC A04/MF A01 CSCL 01/3

An internal hoist for helicopter was developed by AEG-Telefunken to be used for rescue and recovery operations as well as for transporting loads. These hoists are installed in the lightweight helicopter Bell UH-1D and are applied for rescue maneuvers above the sea and in the mountains for the purposes of SAR service. The hoist is assembled from integrated functional groups. Therefore, it can be modified easily to match the requirements of any other type of helicopter. At disasters in terrain difficult of access and to be reached by rescue parties on foot often not until after hours and under great dangers, helicopters equipped with rescue hoists will render quick aid, riskless for the rescue team. The AEG rescue hoist operates reliably and safely without capacity reductions also in great altitude and at extreme low temperatures. Author (GRA)

N77-20089# All American Engineering Co., Wilmington, Del.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THE HOVERING DYNAMICS OF THE AEROCRANE HYBRID HEAVY LIFT VEHICLE Final Report
W. F. Putman and H. C. Curtiss, Jr. Jun. 1976 111 p refs Prepared in cooperation with Princeton Univ., Princeton, N.J.
(Contract N00019-75-C-0418)
(AD-A031443; OS-137; TR-1291) Avail: NTIS HC A06/MF A01 CSCL 01/3

The results of an analytical and experimental investigation of the hovering dynamics of an AEROCRANE hybrid heavy lift vehicle are discussed and compared. Analytical representations of the hovering aerodynamics and equations of motion are developed and discussed. The experimental program, including flight test of a 0.107 scale Froude model, is discussed. Piloted and unpiloted analog computer simulations of the hovering dynamics are compared with flight test results. The influence of feedback stabilization is investigated and recommendations made for a stabilization system to improve the hovering operation by a remote pilot with limited motion cues. Author (GRA)

N77-20090# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Material Engineering Branch.
CONFERENCE ON AEROSPACE TRANSPARENT MATERIALS AND ENCLOSURES Conf. Proc. held at Atlanta, 18-21 Nov. 1975
Samuel A. Marolo, Comp. Apr. 1976 893 p refs
(AF Proj. 2202; AF Proj. 7381)
(AD-A032141; AFML-TR-76-54) Avail: NTIS HC A99/MF A01 CSCL 01/3

The purpose of this report is to make available the technical papers presented at the Eleventh Conference on 'Aerospace Transparent Materials and Enclosures.' Thirty-nine technical papers are presented in seven sessions that address transparency design and performance, characterization, materials and processes, and bird impact resistance. The papers contained herein have been reproduced directly from the original manuscripts. Author (GRA)

N77-20091# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Vehicle Equipment Div.
LABORATORY TEST AND EVALUATION OF A GRAPHITE

EPOXY AIRCRAFT WHEEL Final Report, Jul. 1972 - Jul. 1975
Gerald C. Shumaker Jun. 1976 179 p refs
(AF Proj. 1369)
(AD-A031966; AFFDL-TR-76-54) Avail: NTIS HC A09/MF A01 CSCL 01/3

This report is a detailed description of the laboratory testing of a graphite epoxy aircraft wheel that was designed to fit a Type III, 7.00-8 aircraft tire and withstand the unbraked loads imposed on the A-37B aircraft main wheel. The tests conducted range from the initial pressurization tests to long duration dynamometer slow roll tests. The wheel performed extremely well in these tests and achieved a total of 5,165 roll miles before it developed fatigue cracks. This is more than three times the number of miles required by the MIL-SPEC qualification requirements for the comparable metal wheel. Since this wheel is the first of its kind and only one wheel was tested, several pictures were taken to closely document the appearance of the composite structure throughout the test. The wheel was instrumented with several strain gages and data were taken for various conditions. The strains measured are converted to stresses for a two dimensional orthotropic material. These stresses are then compared to the interaction curves developed using composite lamination theory and the maximum allowable strain criteria. This report is written for a reader who may be completely familiar with the theory used to characterize composite material structures. Author (GRA)

N77-20092# Vought Corp., Dallas, Tex. Systems Div.
S-3A GRAPHITE/EPOXY SPOILER FABRICATION OF TEN SHIPSETS AND DAMAGE REPAIR STUDY Final Technical Report, 1 Jul. 1975 - 30 Jun. 1976
C. Foreman, S. A. McGovern, and R. Knight May 1976 120 p
(Contract N62269-75-C-0428)
(AD-A031931; NADC-76234-30; Rept-2-57110/6R-3293) Avail: NTIS HC A06/MF A01 CSCL 13/8

Contract No. N62269-75-C-0428 initiated in July 1975 authorized two basic tasks: fabrication of 10 shipsets of composite spoilers on a production basis as a follow-on to the prior four-shipset contract N62269-74-C-0629; and an adjunct damage criteria and repair technique study. This report describes the performance for each of these tasks. The four-shipset fabrication effort previously performed for subsequent flight evaluation of these spoilers was described by report NADC-75217-30. (The results of the flight evaluation are described in NATC Report AT-TR-76 dated 30 March 1976.) Fabrication data previously submitted in report NADC-75217-30 has therefore been omitted, where feasible, with only Engineering, Tooling, and Manufacturing improvement changes described within this report. The most significant production change consisted of using an expendable pattern approach for lay up and cut out of the composite material. A reduction in lay-up time and materials waste as well as improved parts quality were thereby realized. Cost comparison data for various quantities of composite versus metal spoilers based on this production contract are included. GRA

N77-20093# Rice Univ., Houston, Tex. Aero-Astronautics Group.
NUMERICAL METHODS IN AEROSPACE SYSTEMS THEORY Final Report, 1 Oct. 1971 - 31 Aug. 1976
Angelo Miele 1976 79 p refs
(Grant AF-AFOSR-2185-72)
(AD-A031935; AAR-132; AFOSR-76-1085TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

This document summarizes the research performed at Rice University during the period 1971-76 under Air Force Grant No. AF-AFOSR-72-2185 in several areas of numerical analysis of interest in aerospace systems theory, namely: (i) solution of nonlinear equations, (ii) solution of differential equations, (iii) mathematical programming problems, and (iv) optimal control problems. The work summarized here is eminently applicable to these areas of aerospace engineering: (i) optimum atmospheric flight trajectories, (ii) optimum extra-atmospheric flight trajectories, (iii) optimum aerodynamic shapes, and (iv) optimum structures. Author (GRA)

N77-20094# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A LOGISTICS SUPPORT COST ANALYSIS OF THE ADVANCED AERIAL REFUELING BOOM M.S. Thesis
Richard T. Jeffreys and Carver L. Sears Sep. 1976 236 p refs
(AD-A032274; GSM/SM/76S-13) Avail: NTIS HC A11/MF A01 CSCL 01C

Under an Air Force contract, Douglas Aircraft Company is developing an Advanced Aerial Refueling Boom (AARB) for the Advanced Tanker/Cargo Aircraft System Program Office (ATCA SPO). The purpose of the AARB development program is to demonstrate that an advanced technology boom system, which will eliminate some of the limitations of the existing KC-135 boom, can be designed and successfully flown. To date, development of the AARB has been mainly oriented toward performance--meeting the design requirements. The ATCA SPO now desires to examine the costs of supporting the proposed design, if it is produced. This thesis is directed toward identifying the differential logistics support costs of the AARB. The Boom Model, a tailored version of the Air Force Logistics Command Logistics Support Cost (LSC) Model, is used to develop the logistics support cost figure of merit for the proposed AARB. The Boom Model is also used to develop a similar figure of merit for the existing KC-135 boom. The values for variables used in the KC-135 boom analysis are obtained from existing Air Force maintenance data collection systems. A methodology for extracting data from these systems is given. Because of the uncertainties associated with early, initial estimates for the AARB, sensitivity analyses are performed on selected variables. Conclusions and recommendations pertaining to both the AARB and KC-135 boom analyses and the LSC Model are given. Author (GRA)

N77-20095# Naval Postgraduate School, Monterey, Calif.
MAN-POWERED FLIGHT M.S. Thesis
Lynn Carter, II Sep. 1976 72 p refs
(AD-A032375) Avail: NTIS HC A04/MF A01 CSCL 01/3

An alternative to the conventional rigid wing was explored to see if any advantage might be obtained by utilizing slotted airfoil sails for wings and a complete shift in emphasis towards a lighter vehicle at the expense of drag penalties. Optimum combinations of size and structural parameters were sought through extensive computer analysis. Various tradeoff considerations for further improving aircraft structural parameters were obtained with aircraft power requirements and the optimum flight v velocity. GRA

N77-20096# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT FROM 1 JANUARY 1962 - 30 JUNE 1976 Semiannual Summary Report
Alan M. Kaniss 1 Nov. 1976 157 p Revised
(AD-A031833) Avail: NTIS HC A08/MF A01 CSCL 01/3

This report is a specialized summary of normal acceleration data recorded by counting accelerometers. Data are separated by calendar time and mission category. Only data reported in the counting accelerometer program are included. Author (GRA)

N77-20097# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
NUMERICAL COMPUTATION OF STRESS INTENSITY FACTORS FOR AIRCRAFT STRUCTURAL DETAILS BY THE FINITE ELEMENT METHOD Final Report, Apr. 1974 - Apr. 1975
Theodore H. H. Pian, James W. Mar, Oscar Orringer, and George Stalk May 1976 118 p refs
(Contract F33615-74-C-3036)
(AD-A031829; ASRL-TR-177-4; AFFDL-TR-76-12) Avail: NTIS HC A06/MF A01 CSCL 01/3

The results of a program of research involving application of the hybrid finite element method to fracture mechanics analyses of several typical aircraft structural details are presented. The performance properties of the specialized finite element building blocks are reviewed. Capabilities of the computer analysis codes are discussed with regard to valid parameter ranges, core storage

requirements and execution times. Numerical results obtained from extended parameter studies are presented in the form of handbook charts. Suggestions are offered for future improvement and comments are made about the limits of applicability of the data base to airframe damage tolerance analysis. Author (GRA)

N77-19991# Hawker Siddeley Aviation Ltd., Kingston upon Thames (England).
EXAMPLES OF LOAD PREDICTION DIFFICULTIES
C. L. Bore *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 6 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20009# General Dynamics/Fort Worth, Tex.
AIRCRAFT MANEUVERS AND DYNAMIC PHENOMENA RESULTING IN RAPID CHANGES OF LOAD DISTRIBUTIONS OR/AND FLUCTUATING SEPARATION
David B. Benepe, Sr. *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 13 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-20098*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CROSSWIND LANDING GEAR POSITION INDICATOR Patent Application
Robert A. Champine, inventor (to NASA) Filed 23 Mar. 1977 8 p
(NASA-Case-LAR-11941-1; US-Patent-Appl-SN-780568) Avail: NTIS HC A02/MF A01 CSCL 01D

An instrument for use on an aircraft equipped with a cross wind landing gear system is described. The instrument indicates on the pilot's display panel of the aircraft the alinement or misalinement of the wheels of the aircraft relative to the runway and to the aircraft's centerline in a manner such that the flight crew will not mistakenly adjust the wheels in the wrong direction. The wheels have automatic and manual modes of operation. In the automatic mode of operation, the wheels are automatically alined with the runway, and the alinement is indicated on the display panel of the aircraft. In the manual mode of operation, the pilot turns the wheels to aline them with the runway. The alinement or misalinement of the wheels is indicated on the display panel. NASA

N77-20099# United Technologies Corp., Norwalk, Conn. Norden Div.
VISUALLY ACTIVATED SWITCH SYSTEM (VASS) Final Report, 19 Feb. - 30 Jul. 1976
E. Potter, P. Burkott, and J. Gordon Sep. 1976 48 p refs Sponsored in part by NADC
(Contract F33615-76-C-0514)
(AD-A031589; Rept-1260-R-0002; AMRL-TR-76-70) Avail: NTIS HC A03/MF A01 CSCL 01/4

The Visually Activated Switching System (VASS) provides a simple means for control system switching during 'hands-on' flight. Switching is accomplished by looking at a cockpit switch and operating a single trigger switch on the stick or throttle. A helmet-mounted aiming reticle, as available in a military VTAS (Visual Target Acquisition System) aims a miniature helmet-mounted infrared transmitter at a selected switch. Standard MIL-spec illuminated pushbutton switches are modified to include detectors that sense the IR energy and cause the switching action. The pushbutton switches may also be operated manually in a normal manner. Failsafe features are included to prevent inadvertent or erroneous switch operation. Two systems were developed. In one, the Model A VASS, the IR transmitter is mounted on an adjustable headband, and a VTAS 'granny glass' reticle is used. The Model B system uses a pilot's flight helmet, and a VTAS parabolic visor aiming reticle. Both systems include a remotely operated switch assembly of four switches mounted on 1-inch centers and a combined controller and electronics unit, containing the remainder of the system circuits. A cable assembly, pilot's trigger switch, and a single test fixture were included. The systems were tested and meet the operating requirements. GRA

N77-20100# McGraw-Edison Co., Inc., Manchester, N.H. Edison Electronics Div.
INTEGRATED FIRE AND OVERHEAT DETECTION SYSTEM Final Report, Period Ending 25 Jun. 1976
George Suminski, Otto Riemer, and Frank Hankey Jun. 1976 311 p refs
(Contract F33615-72-C-1053)
(AD-A032304; AFAPL-TR-76-64) Avail: NTIS HC A14/MF A01 CSCL 01/4

This report describes the background, specifications, design, development, construction and evaluation of an airborne integrated fire and overheat warning system known as the IFOS. It was built to illustrate the possibility of providing fire and overheat detection capability with a high degree of reliability. The IFOS consists of six ultraviolet flame detector heads, two overheat-sensing thermistor cables, a central computer unit, a crew readout unit to indicate fire and overheat conditions, and a maintenance warning unit to indicate component failure. The system is self-testing to an important degree and completely automatic in operation. Three such systems were constructed and extensively tested. Tests included operation under various conditions of input voltage, temperature and altitude. Response times to fire and overheat conditions were measured, and one system was subjected to vibration, shock, humidity, salt spray and electromagnetic interference tests. In addition, a theoretical study of reliability was made. While the above tests uncovered a number of design weaknesses, all of these defects could be overcome in designing an improved model of the IFOS. It is concluded that a high reliability, automatic fire and overheat detection system is definitely feasible. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-20101*# Pratt and Whitney Aircraft, East Hartford, Conn.
ULTRA HIGH TIP SPEED (670.6 m/sec) FAN STAGE WITH COMPOSITE ROTOR: AERODYNAMIC AND MECHANICAL DESIGN
J. E. Halle, G. D. Burger, and R. E. Dundas Mar. 1977 198 p refs
(Contract NAS3-15335)
(NASA-CR-135122; PWA-5487) Avail: NTIS HC A09/MF A01 CSCL 21E

A highly loaded, single-stage compressor having a tip speed of 670.6 m/sec was designed for the purpose of investigating very high tip speeds and high aerodynamic loadings to obtain high stage pressure ratios at acceptable levels of efficiency. The design pressure ratio is 2.8 at an adiabatic efficiency of 84.4%. Corrected design flow is 83.4 kg/sec; corrected design speed is 15,200 rpm; and rotor inlet tip diameter is 0.853 m. The rotor uses multiple-circular-arc airfoils from 0 to 15% span, precompression airfoils assuming single, strong oblique shocks from 21 to 43% span, and precompression airfoils assuming multiple oblique shocks from 52% span to the tip. Because of the high tip speeds, the rotor blades are designed to be fabricated of composite materials. Two composite materials were investigated: Courtaulds HTS graphite fiber in a Kerimid 601 polyimide matrix and the same fibers in a PMR polyimide matrix. In addition to providing a description of the aerodynamic and mechanical design of the

670.0 m/sec fan, discussion is presented of the results of structural tests of blades fabricated with both types of matrices. Author

N77-20102*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.

ANALYTICAL SCREENING OF LOW EMISSIONS, HIGH PERFORMANCE DUCT BURNERS FOR SUPERSONIC CRUISE AIRCRAFT ENGINES Final Report

R. A. Lohmann and G. T. Riecke Mar. 1977 97 p refs

(Contract NAS3-19781)

(NASA-CR-135157; PWA-5489) Avail: NTIS HC A05/MF A01 CSCL 21E

An analytical screening study was conducted to identify duct burner concepts capable of providing low emissions and high performance in advanced supersonic engines. Duct burner configurations ranging from current augmenter technology to advanced concepts such as premix-prevaporized burners were defined. Aerothermal and mechanical design studies provided the basis for screening these configurations using the criteria of emissions, performance, engine compatibility, cost, weight and relative risk. Technology levels derived from recently defined experimental low emissions main burners are required to achieve both low emissions and high performance goals. A configuration based on the Vorbix (Vortex burning and mixing) combustor concept was analytically determined to meet the performance goals and is consistent with the fan duct envelope of a variable cycle engine. The duct burner configuration has a moderate risk level compatible with the schedule of anticipated experimental programs. Author

N77-20103*# Computer Systems International, Inc., Seabrook, Md.

A STUDY OF THE OPTIMIZATION METHOD USED IN THE NAVY/NASA GAS TURBINE ENGINE COMPUTER CODE Final Report

Jerry L. Horsewood and Samuel Pines (Anal. Mech. Assoc., Inc., Jericho, N. Y.) Jan. 1977 63 p refs

(Contract NAS3-20280)

(NASA-CR-135180; AMA-77-1) Avail: NTIS HC A04/MF A01 CSCL 21E

Sources of numerical noise affecting the convergence properties of the Powell's Principal Axis Method of Optimization in the NAVY/NASA gas turbine engine computer code were investigated. The principal noise source discovered resulted from loose input tolerances used in terminating iterations performed in subroutine CALCFX to satisfy specified control functions. A minor source of noise was found to be introduced by an insufficient number of digits in stored coefficients used by subroutine THERM in polynomial expressions of thermodynamic properties. Tabular results of several computer runs are presented to show the effects on program performance of selective corrective actions taken to reduce noise. Author

N77-20104*# Stanford Univ., Calif. Guidance and Control Lab.

POWER PLANT MANAGEMENT SYSTEMS FOR GENERAL AVIATION RECIPROCATING ENGINES Final Report

J. David Powell Dec. 1976 30 p refs

(Grant NsG-2169)

(NASA-CR-151963) Avail: NTIS HC A03/MF A01 CSCL 21A

Power-plant management systems were studied to determine what contributions are made by the avionics system to better control and determine the state of the engine. The desirability and feasibility of incorporating more advanced engine control and monitoring systems to general aviation are addressed. Author

N77-20105*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

PRELIMINARY DESIGN STUDY OF ADVANCED MULTI-STAGE AXIAL FLOW CORE COMPRESSORS Final Report, May 1975 - Jan. 1976

D. C. Wisler, C. C. Koch, and L. H. Smith, Jr. Feb. 1977 95 p refs

(Contract NAS3-19444)

(NASA-CR-135133; R77AEG222) Avail: NTIS HC A05/MF A01 CSCL 21E

A preliminary design study was conducted to identify an advanced core compressor for use in new high-bypass-ratio turbofan engines to be introduced into commercial service in the 1980's. An evaluation of anticipated compressor and related component 1985 state-of-the-art technology was conducted. A parametric screening study covering a large number of compressor designs was conducted to determine the influence of the major compressor design features on efficiency, weight, cost, blade life, aircraft direct operating cost, and fuel usage. The trends observed in the parametric screening study were used to develop three high-efficiency, high-economic-payoff compressor designs. These three compressors were studied in greater detail to better evaluate their aerodynamic and mechanical feasibility. Author

N77-20106*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

NUMERICAL SOLUTION FOR THE TEMPERATURE DISTRIBUTION IN A COOLED GUIDE VANE BLADE OF A RADIAL GAS TURBINE Interim Report

W. Hosny and W. Tabakoff [1977] 62 p refs Sponsored in part by US Army Air Mobility Research and Development Lab., Moffett Field, Calif.

(Contract NAS2-7850)

(NASA-CR-137943) Avail: NTIS HC A04/MF A01 CSCL 21E

A two dimensional finite difference numerical technique is presented to determine the temperature distribution of an internal cooled blade of radial turbine guide vanes. A simple convection cooling is assumed inside the guide vane blade. Such cooling has relatively small cooling effectiveness at the leading edge and at the trailing edge. Heat transfer augmentation in these critical areas may be achieved by using impingement jets and film cooling. A computer program is written in FORTRAN IV for IBM 370/165 computer. Author

N77-20107*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

A NUMERICAL STUDY OF THE TEMPERATURE FIELD IN A COOLED RADIAL TURBINE ROTOR Interim Report

A. Hamed, E. Baskharone, and W. Tabakoff [1977] 71 p refs Sponsored in part by US Army Air Mobility Research and Development Lab.

(Contract NAS2-7850)

(NASA-CR-137951) Avail: NTIS HC A04/MF A01 CSCL 21E

The three dimensional temperature distribution in the cooled rotor of a radial inflow turbine is determined numerically using the finite element method. Through this approach, the complicated geometries of the hot rotor and coolant passage surfaces are handled easily, and the temperatures are determined without loss of accuracy at these convective boundaries. Different cooling techniques with given coolant to primary flow ratios are investigated, and the corresponding rotor temperature fields are presented for comparison. Author

N77-20108*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTICAL DETECTION OF BLADE FLUTTER

W. C. Nieberding and J. L. Pollack 1977 31 p refs Presented at Intern. Turbine Conf., Philadelphia, 27-31 Mar. 1977; sponsored by the Am. Soc. of Mech. Engr.

(NASA-TM-X-73573; E-9022) Avail: NTIS HC A03/MF A01 CSCL 21E

Dynamic strain gages mounted on rotor blades are used as the primary instrumentation for detecting the onset of flutter and defining the vibratory mode and frequency. Optical devices are evaluated for performing the same measurements as well as providing supplementary information on the vibratory characteristics. Two separate methods are studied: stroboscopic imagery of the blade tip and photoelectric scanning of blade tip motion. Both methods give visual data in real time as well as video tape records. The optical systems are described, and representative results are presented. The potential of this instrumentation in flutter research is discussed. Author

N77-20109*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN AND PERFORMANCE OF ENERGY EFFICIENT

PROPELLERS FOR MACH 0.8 CRUISE
Daniel C. Mikkelson, Bernard J. Blaha, Glenn A. Mitchell, and Joseph E. Wikete 1977 32 p refs Presented at the 1977 Natl. Business Aircraft Meeting and Exposition, Wichita, Kas. 29 Mar. - 1 Apr. 1977; sponsored by SAE Century 2
(NASA-TM-X-73612; E-9095; SAE-Paper-770458) Avail: NTIS HC A03/MF A01 CSCL 01C

The increased emphasis on fuel conservation in the world has stimulated a series of studies of both conventional and unconventional propulsion systems for commercial aircraft. Preliminary results from these studies indicate that a fuel saving of 14 to 40 percent may be realized by the use of an advanced high-speed turboprop. This turboprop must be capable of high efficiency at Mach 0.8 cruise above 9.144 km altitude if it is to compete with turbofan powered commercial aircraft. Several advanced aerodynamic concepts were investigated in recent wind tunnel tests under NASA sponsorship on two propeller models. These concepts included aerodynamically integrated propeller/nacelles, area ruling, blade sweep, reduced blade thickness and power (disk) loadings several times higher than conventional designs. The aerodynamic design methodology for these models is discussed. In addition, some of the preliminary test results are presented which indicate that propeller net efficiencies near 80 percent were obtained for high disk loading propellers operating at Mach 0.8. Author

N77-20110*# Detroit Diesel Allison, Indianapolis, Ind.
DEFINITION OF PROPULSION SYSTEM FOR V/STOL RESEARCH AND TECHNOLOGY AIRCRAFT Final Report
Jan. 1977 102 p
(Contract NAS3-20034)
(NASA-CR-135161; EDR-9020) Avail: NTIS HC A06/MF A01 CSCL 21E

Wind tunnel test support, aircraft contractor support, a propulsion system computer card deck, preliminary design studies, and propulsion system development plan are reported. The Propulsion system consists of two lift/cruise turbofan engines, one turboshaft engine and one lift fan connected together with shafting into a combiner gearbox. Distortion parameter levels from 40 x 80 test data were within the established XT701-AD-700 limits. The three engine-three fan system card deck calculates either vertical or conventional flight performance, installed or uninstalled. Design study results for XT701 engine modifications, bevel gear cross shaft location, fixed and tilt fan frames and propulsion system controls are described. Optional water-alcohol injection increased total net thrust 10.3% on a 90 F day. Engines have sufficient turbine life for 500 hours of the RTA duty cycle. Author

N77-20111*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF DIFFERENTIAL SIMILARITY TO FINDING NONDIMENSIONAL GROUPS IMPORTANT IN TESTS OF COOLED ENGINE COMPONENTS
James Sucec Washington Mar. 1977 36 p refs
(NASA-TM-X-3484; E-8943) Avail: NTIS HC A03/MF A01 CSCL 21E

The method of differential similarity is applied to the partial differential equations and boundary conditions which govern the temperature, velocity, and pressure fields in the flowing gases and the solid stationary components in air-cooled engines. This procedure yields the nondimensional groups which must have the same value in both the test rig and the engine to produce similarity between the test results and the engine performance. These results guide the experimentalist in the design and selection of test equipment that properly scales quantities to actual engine conditions. They also provide a firm fundamental foundation for substantiation of previous similarity analyses which employed heuristic, physical reasoning arguments to arrive at the nondimensional groups. Author

N77-20112# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ANALYTICAL STUDY OF MIXED-FLOW JT8D EXHAUST EMISSIONS MEASUREMENTS FOR FIXED-PROBE REQUIREMENTS Final Report, Jan. - Jun. 1973
Gerald R. Slusher Oct. 1976 42 p refs
(FAA Proj. 201-521-000)
(AD-A033121/5; FAA-NA-75-12; FAA-RD-76-140) Avail: NTIS HC A03/MF A01 CSCL 21/5

A method is outlined to optimize the shape, size, and location of fixed probe for acquiring representative emission samples from the exhaust of a mixed-flow JT8D-11 turbofan engine. Families of geometric shapes and mutually exclusive probe configurations are overlaid upon a 177-point traverse grid. A significance ratio is calculated and used to rank results. Representative and nonrepresentative areas of the exhaust plume are defined. Probe configurations are overlaid upon the traverse grid and ranked to obtain a representative configuration. An area of the JT8D exhaust plume suitable for acquiring representative emission samples was found which reduces the overall 177 sample points to 20 sample points. Author

N77-20113*# General Electric Co., Evendale, Ohio. Dept. of Advanced Engineering and Technology Programs.
SINGLE STAGE, LOW NOISE, ADVANCED TECHNOLOGY FAN. VOLUME 5: FAN ACOUSTICS. SECTION 2: ONE-THIRD OCTAVE DATA TABULATIONS AND SELECTED NARROWBAND TRACES Final Report
R. R. Jutras May 1976 479 p refs 5 Vol.
(Contract NAS3-16813)
(NASA-CR-134895; R75AEG431) Avail: NTIS HC A21/MF A01 CSCL 21E

The raw-acoustic data corrected to standard day, from acoustic tests performed on a 0.508-scale fan vehicle of a 111,300 newton thrust, full-size engine, which has application on an advanced transport aircraft, are presented. The single-stage advanced technology fan was designed to a pressure ratio of 1.8 at a tip speed of 503 m/sec to achieve the desired pressure ratio in a single-stage fan with low radius ratio, and to maintain adequate stall margin. The two basic approaches taken in the acoustic design were: (1) minimization of noise at the source, and (2) suppression of the generated noise in the inlet and bypass exhaust duct. Suppression of the generated noise was accomplished in the inlet through use of the hybrid concept (wall acoustic treatment plus airflow acceleration suppression) and in the exhaust duct with extensive acoustic treatment including a splitter. The goal of the design was attainment of twenty effective perceived noise decibels. The suppression goal of FAR 36-20 was not reached, but improvements in the technology of both front and aft fan-noise suppression were realized. Author

N77-20114# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DYNAMIC DIGITAL BLADE ROW COMPRESSION COMPONENT STABILITY MODEL. MODEL VALIDATION AND ANALYSIS OF PLANAR PRESSURE PULSE GENERATION AND TWO-STAGE FAN TEST DATA Final Technical Report, 1 Apr. 1975 - 31 May 1976
G. G. Reynolds and W. G. Steenken Aug. 1976 294 p refs
(Contract F33615-75-C-2029)
(AD-A032079; R76AEG299; AFAPL-TR-76-76) Avail: NTIS HC A13/MF A01 CSCL 01/3

The objectives of this study were to determine the range of validity of a Dynamic Digital Blade Row Compression Component Stability Computer Model by comparing the results of model simulations with previously obtained test data and to determine the manner in which a fan component responded to imposed unsteady aerodynamics by examining calculated parameters. Validation of the modeling technique was obtained by simulating a facility and test conditions where the response of a two-stage fan to planar waves was determined. The simulation of the two-stage fan component was carried out using a quasi one-dimensional, pitch line, blade-row by blade-row model which used blade-row loss coefficients and deviation angles determined from analysis of clean-inlet-flow test data. This model was ideally suited for studying the fan response to the planar waves produced by the Planar Pressure Pulse Generator, a device which produced highly planar waves with peak-to-peak fluctuations of 10-30 percent of the mean total pressure over a frequency range of 42 to 800 Hz. The results of the simulations showed that the model accurately reproduced the waveshape, amplitude, and phase of the experimentally determined fan inlet and exit pressures and the fan inlet flow up to 75 Hz where the need for including unsteady blade circulation effects on blade characteristics began to become apparent. Further, the blade row model showed

accurate simulation of the pressures in the interconnecting ducts by reproducing the wave and its harmonics up to approximately 118 Hz where the length of the volumes becomes too large to provide proper spatial definition of the harmonics of the standing waves although the fundamental frequency is properly reproduced. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-20115*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
EFFECTS OF SIMULATED TURBULENCE ON AIRCRAFT HANDLING QUALITIES
Ira D. Jacobson and Dinesh S. Joshi Mar. 1977 102 p refs (Grant NGR-47-005-208)
(NASA-CR-152621; UVA/528066/ESS77/106) Avail: NTIS HC A06/MF A01 CSCL 01C

The influence of simulated turbulence on aircraft handling qualities is presented. Pilot opinions of the handling qualities of a light general aviation aircraft were evaluated in a motion-base simulator using a simulated turbulence environment. A realistic representation of turbulence disturbances is described in terms of rms intensity and scale length and their random variations with time. The time histories generated by the proposed turbulence models showed characteristics which are more similar to real turbulence than the frequently-used Gaussian turbulence model. The proposed turbulence models flexibly accommodate changes in atmospheric conditions and are easily implemented in flight simulator studies. Author

N77-20011# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
THE PREDICTION OF BUFFET ONSET AND LIGHT BUFFET BY MEANS OF COMPUTATIONAL METHODS
G. Redeker and H.-J. Proksch (Dornier G.m.b.H., W. Germany) *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 10 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20012# Royal Aircraft Establishment, Bedford (England). Dept. of Aerodynamics.
PRELIMINARY EVALUATION OF A TECHNIQUE FOR PREDICTING BUFFET LOADS IN FLIGHT FROM WIND-TUNNEL MEASUREMENTS ON MODELS OF CONVENTIONAL CONSTRUCTION
G. F. Butler and G. R. Spavins *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 11 p refs (For primary document see N77-19990 11-01)
Avail: NTIS HC A15/MF A01

N77-20013# Lockheed Missiles and Space Co., Sunnyvale, Calif.
QUASI-STEADY AND TRANSIENT DYNAMIC STALL CHARACTERISTICS
Lars E. Ericsson and J. Peter Reding *In* AGARD Prediction of Aerodynamic Loading Feb. 1977 11 p refs (For primary document see N77-19990 11-01)
Avail: NTIS

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N77-20116*# Meckler (Gershon) Associates, Washington, D.C. Consulting Engineers, Washington, D. C.
STUDY OF THE APPLICATION OF SOLAR CHEMICAL DEHUMIDIFICATION SYSTEM TO WIND TUNNEL FACILITIES OF NASA LEWIS RESEARCH CENTER AT CLEVELAND, OHIO
15 Jul. 1976 38 p
(Contract NASw-2920)
(NASA-CR-149886) Avail: NTIS HC A03/MF A01 CSCL 14B

Energy utilization and cost payback analyses were prepared for proposed modifications. A 50,000 CFM standard compact packaged solid desiccant dehumidifier utilizing high temperature hot water (HTHW) for desiccant regeneration was added. The HTHW is generated by utilizing solar energy and is stored in a storage tank. A steam boiler is provided as a back-up for the solar system. A 50,000 CFM standard compact package solid desiccant dehumidifier utilizing high temperature hot water (HTHW) for desiccant regeneration was added. The HTHW is generated by utilizing a steam boiler and a heat exchanger and is stored in a storage tank. Author

N77-20117# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
CRITERIA FOR AIRPORT PAVEMENTS Final Summary Report, May 1971 - Dec. 1975
Sep. 1976 142 p
(Contract DOT-FA71WAI-218)
(AD-A032491/3; FAA-RD-35) Avail: NTIS HC A07/MF A01 CSCL 01/5

Through individual studies, design and construction procedures were developed for prestressed concrete, fibrous concrete, and continuously reinforced concrete pavements; porous friction surface courses; and pavements incorporating stabilized layers, insulating layers, and membrane-encapsulated layers. Proposals were made for statistical quality control of paving materials, and a review of soil classification systems applicable to airport pavement design was accomplished. A complete frost and permafrost design procedure for civil airport pavements was formulated. A nondestructive pavement evaluation procedure based on steady state vibratory loadings and measurements of the resulting elastic deflections was developed. An economic analysis was performed to relate pavement upgrading cost to a penalty cost associated with adding gears and wheels to aircraft in order to provide flotation for present-day pavement design criteria. Studies of aircraft dynamic load effects and wheel-path distribution were made. Author

N77-20118# Douglas Aircraft Co., Inc., Long Beach, Calif.
TECHNIQUES FOR DETERMINING AIRPORT AIRSIDE CAPACITY AND DELAY Final Report
Jun. 1976 239 p refs Prepared in cooperation with Peat, Marwick, Mitchell and Co., San Francisco, McDonnell Douglas Automation Co., Long Beach, Calif., and American Airlines, Inc., New York
(Contract DOT-FA72WA-2897)
(AD-A032475/6; FAA-RD-74-124) Avail: NTIS HC A11/MF A01 CSCL 01/5

Methods for determining how best to increase capacity and minimize congestion on an airfield were investigated. Procedures are given for determining the capacity of the airfield and its components and for determining delays to aircraft operating on the airfield. Data are structured to permit the user to choose the method of analysis most suited to the complexity of the user's problem or the level of detail desired. Author

N77-20119# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
IMPROVEMENTS TO AIRPORT DRAINAGE CRITERIA, PHASE 1 Final Report
Jack Fowler Oct. 1976 38 p refs
(Contract DOT-FA75WAI-536)
(AD-A033644/6; FAA-RD-76-59) Avail: NTIS HC A03/MF A01 CSCL 01/5

Most airport pavement damage is caused by free water in the base course and subgrades. Pavement surfaces are difficult to seal, and most airports are constructed on base courses and

subgrades that have low coefficients of permeability and are not capable of removing much water. The best method of controlling and reducing free water in the pavement structural sections and preventing consequent pavement damage is to provide coarse open graded macadam base course drainage layers with collector and outlet pipes. When excess water is not allowed to drain from the structural sections, aircraft traffic can cause pumping, faulting, and other problems that are many times greater than those occurring when there is no free water present. Studies indicate that 80 to 90 percent of all severe damage is caused by excess water in the pavement structural sections. Author

N77-20120# Toronto Univ. (Ontario).
CONDENSATION OF WATER VAPOUR ON HETEROGENEOUS NUCLEI IN A SHOCK TUBE
S. Kotake and I. I. Glass Apr. 1976 60 p refs
(Grant AF-AFOSR-2274-72)
(UTIAS-207; CN-ISSN-0082-5255) Avail: NTIS HC A04/MF A01

A macroscopic model of heterogeneous nucleation is used for a theoretical study of condensation of water-vapor/carrier-gas mixtures in a nonequilibrium nonstationary rarefaction wave generated in a shock tube. The results are compared with those from homogeneous nucleation. Nucleation is assumed to take place heterogeneously on idealized smooth, spherical solid particles of Aitken nuclei, which are chemically and electrically inert. In the processes of heterogeneous condensation, the controlling factors are the size-distribution of nuclei, the concentration of monomers on the surface of the substrate and the contact angle of embryos. Heterogeneous condensation results in less supercooling of the mixture but a faster approach to the equilibrium state. By choosing a suitable value for the contact angle, the numerical results are made to fit the experimental data. Author

N77-20121# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik
A COMPUTER PROGRAM FOR THE DESIGN OF PLANE AND AXISYMMETRIC SUPERSONIC WIND TUNNEL NOZZLES
Kurt Gruemmer 9 Nov. 1976 85 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-367)
(DLR-FB-76-59) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 34,30

A FORTRAN 4 program to calculate the nozzle contour of supersonic wind tunnel nozzles with different slenderness ratio, including the shortest possible overall length, is presented. Since the Prandtl-Meyer corner flow was used, the supersonic flow field of the nozzle generally showed gasdynamic waves of first order accompanied by discontinuities in the curvature of the stream lines. Author (ESA)

N77-20122# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
RECOMMENDED DESIGN FOR RIGID-FLEXIBLE AIRFIELD PAVEMENT JUNCTURES Final Report, Feb. - Apr. 1976
Eugene C. Odom Sep. 1976 31 p
(DA Proj. 4A7-62719-AT-40)
(AD-A031351; WES-MP-S-76-19) Avail: NTIS HC A03/MF A01 CSCL 01/5

A study was conducted on the performance of junctures between rigid and flexible airfield pavements constructed using present criteria. The study consisted of field inspections of 14 rigid-flexible pavement junctures at Williams AFB, Arizona, and Columbus AFB, Mississippi, and discussions of the performance of these junctures with Base Civil Engineering Office personnel. Of the 14 junctures studied, 4 have been repaired and are now in good condition, 1 is in good to fair condition, 1 is in only poor to fair condition, and 8 are in good condition. Although the junctures have performed generally well, the asphaltic concrete pavement portions have experienced some minor problems (namely, humping, transverse cracking, and surface depressions). From the problems associated with the junctures studied, it is recommended that the present design be revised slightly. A recommended revision of the design of rigid-flexible airfield pavement junctures is described. The revision involves use of expansion joints, increased thickness of the asphaltic concrete, and special rolling procedures for the asphaltic concrete binder and surface courses. GRA

N77-20123# ARO, Inc., Arnold Air Force Station, Tenn.
AEROBALLISTIC RANGE INSTRUMENTATION DEVELOPMENT Final Report, Jul. 1972 - Jun. 1975
Paul H. Dugger AEDC Sep. 1976 27 p refs
(ARO Proj. VF201; ARO Proj. VF401)
(AD-A030567; ARO-VKF-TR-76-146; AEDC-TR-76-146) Avail: NTIS HC A03/MF A01 CSCL 19/4

Development of a new photopyrometer instrumentation system, coupled with implementation of a dual-environment test technique, has extended the lower limit for model surface temperature measurements in Hyperballistic Range (G) from 2,500 to 1,900 K. A highspeed sequential photography system has been developed and used to observe test models in hypervelocity flight through erosive environments; experimental evaluations have indicated that a similar photographic system may be applicable for studies of oscillating bow shock waves on certain test models. Model detector systems have been developed and have demonstrated a 93-percent trigger reliability when used in the high-luminosity, blast-tank area of Hyperballistic Range (K); reliability of previously used systems was 70 percent. Other evaluations have shown that high reliability can be expected in applications of these types of detectors for triggering instrumentation systems in the Range K and Range G guided-track facilities. Author (GRA)

N77-20124# Naval Air Test Facility, Lakehurst, N.J.
EVALUATION OF BAK-14 HOOK-CABLE SUPPORT-SYSTEM MODIFICATIONS Final Report, 11 Dec. 1974 - 31 Jul. 1975
Waldemar Wastallo 12 Feb. 1976 53 p refs
(AD-B009581; NATF-EN-1135) Avail: NTIS HC A04/MF A01 CSCL 01/5

The BAK-14 retractable hook-cable support system was designed to raise and restrain the hook cable of the airfield arresting gear above the runway surface for the engagement of hook-equipped aircraft and to lower and retain the hook cable below the runway surface for those aircraft which require a clear runway. When in battery position, or when lowered, the hook cable is installed in rubber support blocks each of which is mounted on a spring-loaded pneumatically-actuated support arm contained within a metal box on the runway. The boxes are located eight feet apart along the trough which accepts the lowered hook cable. The extreme low temperature which exists at the Air Force BAK-14 installation at Galena, Alaska caused the normally pliable rubber support blocks to become brittle and fracture when the hook cable was extracted by the arrested aircraft; the support-arm latch mechanism within the boxes was also damaged and disabled. The tests of this report were conducted to evaluate a number of modifications designed to permit operation of the BAK-14 at extreme low temperatures. The optimum support-block and hook-cable-restraint configuration was selected and satisfactorily tested. The new design support-arm latch mechanism was unsatisfactory due to excessive lost motion in the linkage and also to installation interference; however, this modification is worthy of additional developement. Complete redesign of the support-arm latch mechanism is recommended. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-20125*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ASTRONOMY SPACELAB PAYLOADS STUDY: EXECUTIVE VOLUME Interim Report
Jul. 1975 65 p
(NASA-TM-X-74639) Avail: NTIS HC A04/MF A01 CSCL 22A

The progress of the Astronomy Spacelab Payloads Project at the Goddard Space Flight Center is reported. Astronomical

research in space, using the Spacelab in conjunction with the Space Shuttle, is described. The various fields of solar astronomy or solar physics, ultraviolet and optical astronomy, and high energy astrophysics are among the topics discussed. These fields include scientific studies of the sun and its dynamical processes, of the stars in wavelength regions not accessible to ground based observations, and the exciting new fields of X-ray, gamma ray, and particle astronomy. Author

N77-20126*# National Aeronautics and Space Administration, Washington, D.C.
STRATEGY FOR OUTER PLANETS EXPLORATION
11 Jun. 1975 94 p refs
(NASA-TM-X-74634) Avail: NTIS HC A05/MF A01 CSCL 22A

NASA's Planetary Programs Office formed a number of scientific working groups to study in depth the potential scientific return from the various candidate missions to the outer solar system. The results of these working group studies were brought together in a series of symposia to evaluate the potential outer planet missions and to discuss strategies for exploration of the outer solar system that were consistent with fiscal constraints and with anticipated spacecraft and launch vehicle capabilities. A logical, scientifically sound, and cost effective approach to exploration of the outer solar system is presented. Author

N77-20127# European Space Agency, Paris (France).
SPACE ACTIVITIES IN EUROPE [L'EUROPE SPATIALE]
M. Hauzeur 1976 35 p In FRENCH Presented at the Journees Postuniv. des Ingr. Com., Liege, 27 Mar. 1976
Avail: NTIS HC A03/MF A01

A survey of the ESA space program up to 1980 is presented. The organizational structure and establishments of the Agency are also discussed. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-20128*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
WATER SPRAYS IN SPACE RETRIEVAL OPERATIONS
Douglas C. Freesland Apr. 1977 68 p refs
(Grant NsG-7078)
(NASA-CR-149885; RR-77-2) Avail: NTIS HC A04/MF A01 CSCL 22A

Experiments were conducted in a ground based vacuum chamber to determine physical properties of water-ice in a space-like environment. Additional ices, alcohol and ammonia, were also studied. An analytical analysis based on the conservation of angular momentum, resulted in despin performance parameters, i.e., total water mass requirements and despin times. The despin and retrieval of a disabled spacecraft was considered to illustrate a potential application of the water spray technique. Author

N77-20129*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT: STUDY OF THE EFFECTS OF MULTIPLE GROUND UPDATES ON THE ACCURACY OF THE ONBOARD STATE VECTOR WITH IMU ONLY NAVIGATION
Rosemary Killen 9 Mar. 1977 85 p refs
(Contract NAS9-14960)
(NASA-CR-151240; Working Paper E914-8H-025) Avail: NTIS HC A05/MF A01 CSCL 17G

There are six cases considered: (1) no updates made during the flight, (2) one ground update in the vertical components only at the first practice separation minus 15 minutes, (3) one ground update in all components at the first practice separation minus 5 minutes, (4) updates 2 and 3 applied successively, (5) Case 4 plus an update in all components at the second separation attempt minus 3 minutes, and (6) one ground update at first separation attempt minus 5 minutes and a second update at second separation minus two minutes. The mission control simulation program, GROPER, was run using as radar input a tape containing radar derived state vectors for the trajectory. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N77-20130# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Physikalische Geodaesie.
STUDY ON GROUND STATIONS LOCATION. PART 1: GENERAL PRESENTATION INCLUDING DESCRIPTION OF THE TECHNICAL PROBLEMS AND EXAMINATIONS CARRIED OUT. SUMMARY
Erwin Groten 1976 9 p 2 Vol.
(Contract ESOC-748/75-AR)
(IPG-10-Pt-1-Summ; ESA-CR(P)-895-Pt-1) Avail: NTIS HC A02/MF A01

The geocentric location of satellite ground stations is determined by a combination of terrestrial geodetic data with long range satellite information for stations at Redu (Belgium) and Rehbach (Germany). By transforming the data to the European Datum (ED 1950), station coordinates, gravity anomalies, geoid undulations, and plumb line deflections are used in order to determine the geocentric station location with respect to one of the well established global systems. This is basically done by least square procedures when station coordinates, geoid heights, and plumb line deflections referred to ED 1950 are related to corresponding data in the global system. ESA

N77-20131# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Physikalische Geodaesie.
STUDY ON GROUND STATIONS LOCATION. PART 2: DETAILED DISCUSSION AND DESCRIPTION OF TECHNICAL SOLUTIONS
Erwin Groten 1976 85 p refs 2 Vol.
(Contract ESOC-748/75-AR)
(IPG-10-Pt-2; ESA-CR(P)-895-Pt-2) Avail: NTIS HC A05/MF A01

For abstract, see N77-20130.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-20132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING 75 ORBITER SYSTEM TEST AND LAUNCH OPERATIONS. VOLUME 2: LAUNCH OPERATIONS Final Report
31 Jan. 1977 56 p refs Sponsored by NASA 2 Vol.
(NASA-CR-149892; JPL-611-132-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 22D

The activities and results of the test and operations program performed on the three orbiter spacecraft (VO-1, VO-2, and VO-3) are described. Author

N77-20133*# BDM Corp., Vienna, Va.
TDRSS OPERATIONS CONTROL ANALYSIS STUDY Final Report, Feb. - Nov. 1976
Nov. 1976 507 p refs
(Contract NAS5-22990)
(NASA-CR-152463; BDM/W-76-162-TR) Avail: NTIS HC A22/MF A01 CSCL 22A

The use of an operational Tracking and Data Relay Satellite

System (TDRSS) and the remaining ground stations for the STDN (GSTDN) was investigated. The operational aspects of TDRSS concepts, GSTDN as a 14-site network, and GSTDN as a 7 site-network were compared and operations control concepts for the configurations developed. Man/machine interface, scheduling system, and hardware/software tradeoff analyses were among the factors considered in the analysis. Author

N77-20134# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Dept.
GEOS NUTATION DAMPER HANDLING AND INSTALLATION PROCEDURES
L. J. Ancher 18 Mar. 1975 4 p refs
(FOK-RV-75-27) Avail: NTIS HC A02/MF A01

The instructions for unpacking, handling, and mounting the GEOS nutation damper in the satellite are given. ESA

N77-20135# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Dept.
DETERMINATION OF THE CONDUCTION OVER THE GEOS SHORT RADIAL BOOM HINGE
R. Hamann 14 May 1975 10 p
(FOK-RV-75-43) Avail: NTIS HC A02/MF A01

The results of the GEOS short radial boom hinge conduction test carried out in the Fokker thermal vacuum facility according to specifications TS G 5D11 are given. The experimental setup and instrumentation are described. ESA

N77-20136# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Dept.
DETERMINATION OF THE CONDUCTION OVER THE GEOS UHF ANTENNA MECHANISM HINGE BEARING
R. J. Hamann 16 Jun. 1975 9 p
(FOK-RV-75-55) Avail: NTIS HC A02/MF A01

The results of the GEOS UHF antenna mechanism UAM hinge bearing conduction test carried out in the Fokker thermal vacuum facility according to GEOS test specification TS G 5D11 are presented. The test item was one of the UAM short rods, taken from the UAM assy of the thermal model. Test setup and instrumentation are described. ESA

N77-20137# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Dept.
FLIGHT TEMPERATURE PREDICTIONS GEOS UAM ASSY - ROD CIRCUMFERENTIAL GRADIENTS
R. Hamann 18 Jun. 1975 7 p
(FOK-RV-75-57) Avail: NTIS HC A02/MF A01

To determine the maximum circumferential gradient of the UHF antenna mechanism rods, calculations were performed by means of a 74-node model of the long rod in the deployed antenna configuration. The largest gradients can be expected if the rod is partially shadowed by the S/C body, i.e., at a solar aspect angle of 117 deg. ESA

N77-20138# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Dept.
TEST PLAN FOR THE AEROSAT NUTATION DAMPER
L. J. Ancher 23 Oct. 1975 21 p refs
(FOK-RV-75-95) Avail: NTIS HC A02/MF A01

Tests to be performed with the Aerosat nutation dampers models are described and the applicable equipment specified. It includes mechanical characteristics determination, leak tests, environmental tests, damping performance tests, and acceptance tests. ESA

N77-20139# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
DESIGN OF AN ATTITUDE STABILIZATION SYSTEM FOR THE SMALL METEOROLOGICAL SATELLITE POMS [AUSLEGUNG EINES LAGESTABILISIERUNGSSYSTEMS FUER DEN KLEINEN METEOROLOGISCHEN SATELLITEN POMS]
J. Puls and R. Stapf 23 Sep. 1976 21 p refs In GERMAN
(DLR-IB-552-76/8) Avail: NTIS HC A02/MF A01

An attitude stabilization system is proposed for a meteorological satellite program, POMS (Polar Orbiting Meteorological Satellite). Its mission is to measure the radiative exchange between earth and space. The system should allow a simultaneous instrument pointing at sun and earth. Existing methods and sensors which permit reliable operation and low-cost realization were selected. ESA

N77-20140# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
STUDY ON GEOSYNCHRONOUS MULTIDISCIPLINARY EARTH OBSERVATION SATELLITES (MEOS). VOLUME 1: EXECUTIVE SUMMARY Final Report
Nov. 1976 78 p Prepared jointly with BAC, Bristol, Engl. and Soc. d'Etudes Tech. et Entreprises Gen., Buc, France
(Contract ESA-SC/127/76-HQ)
(ESA-CR(P)-897) Avail: NTIS HC A05/MF A01

Requirements for a multidisciplinary earth observation satellite system in geosynchronous orbit were analyzed. A methodology for selection of candidate missions is presented taking into account the particular characteristics of geosynchronous orbits for observation of transient phenomena on the earth and ocean surface and in the atmosphere. The conceptual design of the payload and the spacecraft features modularity and flexibility. It includes a preliminary design of a one meter Ritchey-Chretien optical telescope as main instrument on a satellite which could be launched by Ariane into a geostationary orbit. The preferred concept allows exchange of focal plane elements to permit the performance of different kinds of measurement from high resolution imaging to vertical sounding. The preferred satellite concept is based on a three axis stabilized spacecraft. Particular attention was given to investigation of the attitude measurement and control subsystem necessary to achieve the extreme performance requirements compatible with high resolution imaging of the earth from geostationary orbit. Author (ESA)

N77-20141# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NOMINAL EVENT SUPPORT: THE OBSERVATION OF SYNCHRONOUS SATELLITE NUMBER 83594 BY GEODSS ON DAYS 181, 182, 183 AND 184, 1976 (UTC)
Robert Weber 23 Jul. 1976 26 p
(Contract F19628-76-C-0002; AF Proj. 2128)
(AD-A029919; ETS-2; ESD-TR-76-216) Avail: NTIS HC A03/MF A01 CSCL 17/8

The results of observations of objects associated with satellite 83594, made from the Lincoln Laboratory GEODSS site on days 181, 182, 183, and 184 (UTC), 1976, are reported. Metric, brightness, and signature data are presented on as many as three objects which were detected simultaneously in the nominal one-half degree field-of-view of the system, while the telescope was pointed in accordance with the SDC orbital elements for 83594. One of the brighter objects, detectable during the first three periods of observation, could not be located, even after a nominal two-degree search at increased system sensitivity, on the 184th day. Author (GRA)

N77-20142# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE EFFECTS OF INCREASED MISSILE GUIDANCE SET INPUT RATE ON THE MINUTEMAN 3 MISSILE GUIDANCE SET REPAIR PROCESS AT THE AEROSPACE GUIDANCE AND METROLOGY CENTER M.S. Thesis
Maxwell R. Flint and David O. Reck Jun. 1976 169 p refs
(AD-A030289; SLSR-4-76A) Avail: NTIS HC A08/MF A01 CSCL 17/7

The Aerospace Guidance and Metrology Center (AGMC) is a vital link in the Air Force's logistics support network. An important portion of AGMC's work load is the repair of the Minuteman III Missile Guidance Set (MGS). The importance of maintaining strategic missile operational capability dictates that AGMC be able to cope with current MGS work loads and to absorb changing work loads. If the average input rate were to increase due to changing mission requirements, AGMC managers would have to estimate what extra resources should be committed to MGS repair. The study is conducted using a GPSS V model to simulate the system level repair process for the MGS and the subsystem level repair process for the gyro stabilized platform. Through simulation of increased MGS input rate, the model identifies specific repair resource requirements at each of seven increased rates, up to 200 percent of normal. The simulation program with its extensive use of standardization and modulariza-

tion, Macro statements that simplify coding and input of data, and indirect referencing, is a simplified approach to computer simulation. Author (GRA)

N77-20143# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Concrete Lab.
STRUCTURAL TESTING AND ASSOCIATED DATA REDUCTION FOR A GUIDED PROJECTILE CONTROL HOUSING Final Report
Carl E. Pace Sep. 1976 93 p refs
(AD-A029905; WES-MP-C-76-10) Avail: NTIS
HC A05/MF A01 CSCL 19/1

The testing and data reduction were accomplished for a guided projectile control housing for the U. S. Army Artillery Command, Rock Island, Illinois. The tests were performed by using the CL's 2.4-million-pound testing machine. Forty-one channels of data were recorded on magnetic tape in analog form. The analog data were then digitized and computer programs written or modified to locate specific data on the digitized tapes, apply a baseline shift, apply a calibration factor, draw and label specified coordinate axes, and plot the data. The significant point about this project is that by using a graphics terminal, hard copier, and appropriate computer programs data, plots of 500 points can be obtained from digitized tapes readily and for a cost of six dollars or less per plot. GRA

N77-20144# Panametrics, Inc., Waltham, Mass.
AN ELECTROSTATIC ANALYZER FOR AN AIR FORCE SATELLITE PAYLOAD. EVALUATION OF IN-FLIGHT OPERATION Final Report, Dec. 1972 - Jul. 1976
Frederick A. Hanser and Bach Sellers Hanscom AFB, Mass. AFGL Jul. 1976 30 p refs
(Contract F19628-73-C-0019; AF Proj. 7601)
(AD-A031313; AFGL-TR-76-0203) Avail: NTIS
HC A03/MF A01 CSCL 04/1

A satellite-borne electron spectrum analyzer has been developed, fabricated and flown on the S3-2 satellite. The instrument is a parallel plate electrostatic analyzer, and makes a 32-point spectrum analysis of electrons between 0.08 to 17 keV. The electron ESA was launched in late 1975, and was still operating properly in July 1976. Much electron data from the north and south auroral zones and polar regions have been returned. The ESA appears to be capable of operating properly for some years, assuming normal operation of the other satellite components. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N77-20145*# Calspan Corp., Buffalo, N.Y.
RESULTS OF THE NASA/MSFC FA-23 PLUME TECHNOLOGY TEST PROGRAM PERFORMED IN THE NASA/AMES UNITARY WIND TUNNELS
K. C. Hendershot Feb. 1977 83 p ref
(Contract NAS8-31636)
(NASA-CR-150216; XN-5798-A-2) Avail: NTIS
HC A05/MF A01 CSCL 01A

A 2.25% scale model of the space shuttle external tank and solid rocket boosters was tested in the NASA/Ames Unitary 11 x 11 foot transonic and 9 x 7 foot supersonic tunnels to obtain base pressure data with firing solid propellant exhaust plumes. Data system difficulties prevented the acquisition of any useful data in the 9 x 7 tunnel. However, 28 successful rocket test firings were made in the 11 x 11 tunnel, providing base pressure data at Mach numbers of 0.5, 0.9, 1.05, 1.2, and 1.3 and at plume pressure ratios ranging from 11 to 89. Author

N77-20146*# Chrysler Corp., New Orleans, La. Space Div.
TRANSONIC CONTROL EFFECTIVENESS FOR FULL AND PARTIAL SPAN ELEVON CONFIGURATIONS ON A 0.0165 SCALE MODEL SPACE SHUTTLE ORBITER TESTED IN THE LARC 8-FOOT TRANSONIC WIND TUNNEL (LA48)
Mar. 1977 208 p ref
(Contract NAS9-13247)
(NASA-CR-151061; DMS-DR-2184) Avail: NTIS
HC A10/MF A01 CSCL 01A

A transonic pressure tunnel test is reported on an early version of the space shuttle orbiter (designated 089B-139) 0.0165 scale model to systematically determine both longitudinal and lateral control effectiveness associated with various combinations of inboard, outboard, and full span wing trailing edge controls. The test was conducted over a Mach number range from 0.6 to 1.08 at angles of attack from -2 deg to 23 deg at 0 deg sideslip. Author

N77-20147*# Chrysler Corp., New Orleans, La. Space Div.
SUPERSONIC CONTROL EFFECTIVENESS FOR FULL AND PARTIAL SPAN ELEVON CONFIGURATIONS ON A 0.0165 SCALE MODEL SPACE SHUTTLE ORBITER TESTED IN THE LARC UNITARY PLAN WIND TUNNEL (LA49)
Mar. 1977 101 p ref
(Contract NAS9-13247)
(NASA-CR-151062; DMS-DR-2182) Avail: NTIS
HC A06/MF A01 CSCL 01A

A wind tunnel test is reported on an early version of the space shuttle orbiter (designated 089B-139) 0.0165 scale model to systematically determine both longitudinal and lateral control effectiveness associated with various combinations of inboard, outboard, and full span wing trailing edge controls. The test Mach umbers were 2.5 and 4.63 over an angle of attack range from -4 deg to 42 deg at 0 deg sideslip. Author

N77-20148*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT: DISPERSION ANALYSIS FOR THE FIRST ORBITAL FLIGHT TEST (OFT-1) MISSION
L. S. Snow 25 Feb. 1977 37 p refs
(Contract NAS9-14960)
(NASA-CR-151239; DN-1.4-7-48) Avail: NTIS
HC A03/MF A01 CSCL 22A

A dispersion analysis considering 3-sigma uncertainties (or perturbations) in platform, vehicle, and environmental parameters was performed for the first orbital flight test (OFT-1) mission. The dispersion analysis is based on the nominal trajectory for the OFT-1 reference flight profile. The analysis was performed to determine state vector and performance dispersions (or variations) which result from the indicated 3-sigma uncertainties. The dispersions are determined at major mission events and fixed times from liftoff (time slices). The dispersion results are used to evaluate the capability of the vehicle to perform the mission within a 3-sigma level of confidence and to determine flight performance reserves. Author

N77-20149*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Houston Astronautics Div.
TAILCONE ON ORBITER ALTITUDE ATTAINABLE AT THE MAXIMUM ALT INTERFACE AIRSPEED
G. M. Glenn 31 Mar. 1977 23 p refs
(Contract NAS9-14960)
(NASA-CR-151241; DN-1.4-7-49) Avail: NTIS
HC A02/MF A01 CSCL 22A

A preflight analysis performed for verification of the ALT mated vehicle incidence angle which maximizes the post separation altitude attainment by the orbiter at the maximum approach and landing test (ALT) interface airspeed (300 KEAS) is discussed. In the analysis, altitude versus airspeed profiles are generated for each of the three incidence angles that include and bound the recommended incidence angle for both the forward and the aft cg tailcone on orbiter configurations. Results show that the recommended incidence angles maximize the orbiter post separation altitude attainable within an acceptable tradeoff between separation clearance capability and orbiter structural constraints. Within constraints, the incidence angle that maximizes the orbiter altitude at the maximum ALT interface airspeed for both the forward and aft cg orbiter tailcone on configurations is 6.0 deg. The requirement for a parametric analysis of orbiter altitude attainable at the maximum ALT interface airspeed is stated along with the specifications, assumptions, and analytical

approach used to determine orbiter altitude attainable at the maximum ALT interface airspeed. Author

N77-20150*# Airborne Instruments Lab., Melville, N.Y.
ADAPTIVE MULTIBEAM PHASED ARRAY DESIGN FOR A SPACELAB EXPERIMENT Final Report
T. T. Noji, S. Fass, A. M. Fuoco, and C. D. Wang Mar. 1977 296 p
(Contract NAS5-23469)
(NASA-CR-152460; C751) Avail: NTIS HC A13/MF A01 CSCL 22A

The parametric tradeoff analyses and design for an Adaptive Multibeam Phased Array (AMPA) for a Spacelab experiment are described. This AMPA Experiment System was designed with particular emphasis to maximize channel capacity and minimize implementation and cost impacts for future austere maritime and aeronautical users, operating with a low gain hemispherical coverage antenna element, low effective radiated power, and low antenna gain-to-system noise temperature ratio. Author

N77-20151*# Ohio State Univ., Columbus. ElectroScience Lab.
DEFINITION STUDY FOR SPACE SHUTTLE EXPERIMENTS INVOLVING LARGE, STEERABLE MILLIMETER WAVE ANTENNA ARRAYS Final Report, 16 May 1974 - 30 Sep. 1975
Curt A. Levis Jul. 1976 39 p refs
(Contract NAS5-20521)
(NASA-CR-152466; ESL-3931-3) Avail: NTIS HC A03/MF A01 CSCL 22A

Potential uses and techniques for the Shuttle Spacelab Millimeter Wave Large Aperture Antenna Experiment (MWLAE) are identified. These include: applications to radio astronomy (and in particular to the identification of organic molecules in interstellar matter), the sensing of atmospheric turbulence by its effect on water-vapor line emissions, and the monitoring of oil spills by multifrequency radiometry. It is demonstrated that IF combining is preferable to RF combining with respect to signal-to-noise ratio for communications receiving antennas of the size proposed for MWLAE. A design approach using arrays of subapertures is proposed to reduce the number of phase shifters and mixers for uses which require a filled aperture. It is shown that the usual radiometry approach, using RF combination followed by a Dicke receiver (in the case of beam-forming, several such receivers), is unsuited to arrays as large as the proposed MWLAE. Correlation radiometry and a novel scheme utilizing synchronous Dicke switches and IF combining are proposed as potential solutions. Author

N77-20152# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
PRELIMINARY ACCOMMODATION STUDY FOR A MATERIAL SCIENCE PAYLOAD. DATA SUMMARY AND OPERATIONAL ACCOMMODATION OF SELECTED FIRST MISSION EXPERIMENTS Final Report
22 Oct. 1976 146 p
(Contract ESA-2679/76/F/WMT(SC))
(ESA-CR(P)-888) Avail: NTIS HC A07/MF A01

The equipment requirements of the material science experiments recommended for the first Spacelab mission are reviewed. Operational requirements with respect to duration, utilization of facilities, and peripheral equipment are laid down. Based on the characteristics of the envisaged facilities known to date, an operational accommodation analysis was performed and documented. Author (ESA)

N77-20153# European Space Research and Technology Center, Noordwijk (Netherlands).
SPACELAB DEVELOPMENT STATUS REPORT
Heinz Stoewer and Hans Hoffmann (Ver. Flugtech. Werke Fokker/ERNO) 1976 7 p Presented at the 13th Space Congr., Cocoa Beach, Calif., Apr. 1976
Avail: NTIS HC A02/MF A01

The current state of development of the Spacelab project is described from a technical, manufacturing, schedule and cost point of view. The evolution of the project from the initiation of phase C/D is presented, major events such as the preliminary and subsystem requirements reviews are summarized, and the evolution of the requirements and the configurational concept is described. The status presentation concentrates on the overall project definition from a system viewpoint and describes in depth the status of the hardware development in each of the Spacelab subsystems and the participation of each of the co-contractors. The schedule manpower and expenditures status for the overall project are summarized, and a short preview for the coming events is given. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-20154*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GUIDANCE OF AN AEROMANEUVERING ORBIT-TO-ORBIT SHUTTLE THROUGH A STATISTICALLY VARYING ATMOSPHERE M.S. Thesis - George Washington Univ.
John Joseph Rehder Jun. 1975 59 p refs
(NASA-TM-X-74638) Avail: NTIS HC A04/MF A01 CSCL 22A

One candidate for a reusable upper stage to be carried by the space shuttle is an aeromaneuvering orbit-to-orbit shuttle (AMOOS). This concept uses the drag of the vehicle during a pass through the atmosphere rather than the propulsion system to slow the vehicle on a return from a high energy orbit. The nature and magnitude of the sensitivity of AMOOS to uncertainties in the properties of the atmosphere are shown. Various guidance schemes for correcting for the effects that the unpredictable variations in the atmosphere have on the trajectory are discussed. For the mission studied here, a payload retrieval from geosynchronous orbit with aerodynamic plane change, a linear feedback guidance scheme was developed. A relatively simple heuristic law was used to demonstrate the concept. Using optimal control theory a feedback law was developed analytically. Testing with a large number of different atmospheres showed this law to be a feasible means of controlling the AMOOS trajectory. Refinements to the technique offer promise of significant improvement, and these are discussed. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-20155*# General Dynamics/Convair, San Diego, Calif.
INVESTIGATION OF LIGHTWEIGHT DESIGNS AND MATERIALS FOR LO2 AND LH2 PROPELLANT TANKS FOR SPACE VEHICLES, PHASE 1 Interim Report
Dec. 1975 134 p refs
(Contract NAS8-31370)
(NASA-CR-150222; PD-75-0117) Avail: NTIS HC A07/MF A01 CSCL 22A

Design, analysis, and fabrication studies were performed on nonintegral (suspended) tanks using a representative space tug design. The LH2 and LO2 tank concept selection was developed. Tank geometries and support relationships were investigated using tug design propellant inertias and ullage pressures, then compared based on total tug systems effects. The tank combinations which resulted in the maximum payload were selected. Tests were conducted on samples of membrane material which was processed

in a manner simulating production tank fabrication operations to determine fabrication effects on the fracture toughness of the tank material. Fracture mechanics analyses were also performed to establish a preliminary set of allowables for initial defects.
Author

N77-20156*# General Dynamics/Convair, San Diego, Calif.
INVESTIGATION OF LIGHTWEIGHT DESIGNS AND MATERIALS FOR LO2 AND LH2 PROPELLANT TANKS FOR SPACE VEHICLES, PHASE 2 AND PHASE 3 Final Report
Dec. 1976 226 p ref
(Contract NAS8-31370)
(NASA-CR-150223; PD-76-0200) Avail: NTIS HC A11/MF A01 CSCL 22A

Full size Tug LO2 and LH2 tank configurations were defined, based on selected tank geometries. These configurations were then locally modeled for computer stress analysis. A large subscale test tank, representing the selected Tug LO2 tank, was designed and analyzed. This tank was fabricated using procedures which represented production operations. An evaluation test program was outlined and a test procedure defined. The necessary test hardware was also fabricated.
Author

N77-20157# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
FINITE-ELEMENT ANALYSIS OF CTS-LIKE FLEXIBLE SPACECRAFT
P. K. Nguyen and P. C. Hughes Jun. 1976 108 p refs
Sponsored by the Dept. of Communications, Ottawa
(UTIAS-205; CN-ISSN-0082-5255) Avail: NTIS HC A06/MF A01

The dynamics of a class of non-spinning flexible spacecraft were studied. The spacecraft consists of a relatively rigid center body to which a number of flexible appendages are rigidly attached. The center body has pitch, roll, and yaw attitude motion. Deformations of the appendages are assumed elastic, small in amplitude, and are studied via a finite element analysis. Using a transformation from distributed displacements to finite element displacements, the angular momenta and moments of inertia of the flexible appendages are expressed in terms of elemental inertia matrices.
Author

N77-20158# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
NEAR RESONANT VIBRATION TESTS OF AN ORBITING FLEXIBLE SPACECRAFT: THEORY, DESIGN AND SIMULATION
S. C. Garg Nov. 1976 183 p refs
(Contract NRC-5-7309)
(UTIAS-204; CN-ISSN-0082-5255) Avail: NTIS HC A09/MF A01

A proposed dynamics experiment is presented on the joint U.S./Canada Communications Technology Satellite. The experiment is to excite the spacecraft in flight by means of thrusters and measure dynamic response characteristics suing accelerometers, and to compare the results with an analytical model of the flexible spacecraft dynamics. A pulse-train input is designed which is intended to be as close as possible to the spacecraft natural frequency. The response to it of the spacecraft, which is actively controlled, is explored by means of simple theory as well as a detailed digital attitude control simulation, to which flexible dynamics blocks were added. Inputs slightly off resonance are also considered. It is verified by simulation that the spacecraft attitude and structural disturbances during this experiment are acceptable with resonant excitation of twist and in-plane and out-of-plane bending modes individually, while yielding adequate data.
Author

N77-20159*# Abcor, Inc., Wilmington, Mass.
EVALUATION OF TECHNIQUES FOR REMOVAL OF SPACECRAFT CONTAMINANTS FROM ACTIVATED CARBON Final Report
Kenneth J. McNulty, Robert L. Goldsmith, Gordon A. Goldsmith, Peter R. Hoover, Jerry Nwankwo, and Amos Turk Mar. 1977 108 p refs
(Contract NAS2-8742)
(NASA-CR-151968) Avail: NTIS HC A06/MF A01 CSCL 22B

Alternative techniques for the regeneration of carbon contaminated with various spacecraft contaminants were evaluated. Four different modes of regeneration were evaluated: (1) thermal desorption via vacuum, (2) thermal desorption via nitrogen purge, (3) in-situ catalytic oxidation of adsorbed contaminants, and (4) in-situ non-catalytic oxidation of adsorbed contaminants.
Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N77-20160*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF VIKING LANDER BAROMETRIC PRESSURE SENSOR
Michael Mitchell Mar. 1977 111 p
(NASA-TM-X-74020) Avail: NTIS HC A06/MF A01 CSCL 14B

Variable reluctance type pressure sensors were evaluated to determine their performance characteristics related to Viking Mission environment levels. Static calibrations were performed throughout the evaluation over the full range of the sensors using two point contact manometer standards. From the beginning of the evaluation to the end of the evaluation, the zero shift in the two sensors was within 0.5 percent, and the sensitivity shift was 0.05 percent. The maximum thermal zero coefficient exhibited by the sensors was 0.032 percent over the temperature range of -28.89 C to 71.11 C. The evaluation results indicated that the sensors are capable of making high accuracy pressure measurements while being exposed to the conditions mentioned.
Author

N77-20161# European Space Research and Technology Center, Noordwijk (Netherlands).
PERFORMANCE ANALYSIS OF ON-BOARD PARTICLE- OR PHOTON-COUNTING EXPERIMENTS AND THE EFFECTS OF PROCESSING AND TELEMETRY-RATE CONSTRAINTS
R. W. Okkes Paris ESA Jan. 1977 40 p refs
(ESA-TM-168) Avail: NTIS HC A03/MF A01

The inherent limitations relevant to data extraction from raw input data obtained from particle or photon counting experiments are analyzed. The analysis is given in terms of the obtainable accuracy and resolution of the desired parameters describing the data source characteristics, such as particle energy and spatial distributions, intensity variation with time, and power spectral density. The effects of the standard ESA onboard processor and telemetry constraints in using the processing methods analyzed are evaluated. Possible benefits for the Exosat mission of applying the processing methods described are illustrated. Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-20162* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANODE FOR ION THRUSTER Patent
Bruce A. Banks, inventor (to NASA) Issued 15 Mar. 1977 4 p Filed 8 Mar. 1976 Supersedes N76-19227 (14 - 10, p 1228)
(NASA-Case-LEW-12048-1; US-Patent-4,011,719; US-Patent-Appl-SN-665033; US-Patent-Class-60-202; US-Patent-Class-313-230; US-Patent-Class-313-231.3; US-Patent-Class-313-360; US-Patent-Class-315-111.3;

US-Patent-Class-315-111.6) Avail: US Patent Office CSCL 21C

The anode is constructed of a woven mesh screen, preferably of stainless steel wire cloth with a mesh size less than the intergrid gap or openings of the screen grid or accelerator grid systems of the ion thruster. The screen anode is sputter coated with tantalum as a result of thruster operation. Because of the fineness of the screen anode any spalled material from the tantalum coated anode is in such small dimensions that the spalled pieces cannot interfere with the accelerator and screen grid systems and with the focusing therebetween.

Official Gazette of the U.S. Patent Office

N77-20163*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GRAPHICAL METHOD FOR PREDICTING LIFE OF A ROCKET THRUST CHAMBER WITH HALF-HARD ZIRCONIUM-COPPER LINER AND ELECTROFORMED NICKEL CLOSEOUT

Harold J. Kasper Washington Mar. 1977 29 p refs (NASA-TM-X-3499; E-8971) Avail: NTIS HC A03/MF A01 CSCL 21H

A method for estimating the life of a regeneratively cooled rocket thrust chamber was developed and is based on the hot-gas wall temperature and the temperature difference between the hot-gas wall and the outside surface of the closeout. This method permits a quick estimate of the life of a thrust chamber when design changes or test-cycle variations are considered. Strain range and life are presented graphically as functions of these temperature parameters for a typical high-performance rocket thrust chamber with a half-hard zirconium-copper liner and an electroformed nickel closeout. Author

N77-20164# Hercules, Inc., Magna, Utah. Bacchus Works.

EXTENDED CASE LINER BOND ANALYSIS Final Report, 1 Aug. 1975 - 1 Jun. 1976

S. P. Purcell and J. M. Anderson Aug. 1976 164 p refs (Contract F04611-75-C-0074) (AD-A031284; H111-12-008; AFRPL-TR-76-52) Avail: NTIS HC A08/MF A01 CSCL 21/9

Parametric structural design/analysis curves for use in assessing case bond integrity at flap termination in rocket motors with domed grain configurations were developed. Axisymmetric grains with domed ends were considered. A plane, of symmetry was assumed at the axial mid-plane, and stress solutions were obtained for only one half of the motor. Stress solutions were obtained for conditions with the grain flapped to the tangent line (unbonded dome) and fully bonded to the insulator in the dome, except for a short 1-inch flap (bonded dome). For W/b 0.786 and L/D 1.0 (where L is the bonded length), stress solutions were additionally obtained for domes 33 and 67 percent bonded. The FE models used the same grid detail and refinement adjacent to the bond termination as the flapped flat-ended cylinder studies. Results are reported. Author

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-20165*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INFRARED CHARACTERIZED SPACECRAFT CONTAMINANTS AND RELATED COMPOUNDS

Frederick C. Gross Apr. 1977 35 p refs (NASA-TN-D-8451; G7702-F-13) Avail: NTIS HC A03/MF A01 CSCL 07D

The limits of the infrared region of the electromagnetic spectrum are discussed, together with an explanation of some of the shortcomings of obtaining data in this range. Similarities and differences in the interest taken by the chemist/spectroscopist and the space/spectroscopist in the IR spectrum are discussed. The chemist uses IR spectra to identify materials and contaminants associated with spacecraft fabrication and testing. The space scientist, using IR spectrometry, can determine atmospheric conditions around planets, stars, and galaxies. He could also determine the temperature profile of the Earth's atmosphere at different altitudes, or even the temperature profile of the Sun. The importance of detecting contamination of spacecraft and the possible results of not taking corrective action are explored. All space experiments contain some contaminants, to a lesser or greater degree; the responsible personnel involved must determine the level of toleration. A collection of IR spectra of known spacecraft contaminants is presented as a guide for cognizant scientists and engineers. Author

N77-20166# Argonne National Lab., Ill.

DISPERSION STRENGTHENING

R. O. Scattergood and E. S. P. Das 1976 13 p refs Presented at Conf. on Computer Simulation for Mater. Appl., Gaithersburg, Md., 19 Apr. 1976 (Contract W-31-109-eng-38) (CONF-760421-8) Avail: NTIS HC A02/MF A01

Using digital computer-based methods, models for dispersion strengthening are developed. In particular, the self interaction of a dislocation is treated, and a computer simulation method to determine the flow stress of a random distribution of circular, impenetrable obstacles was developed taking into account all such interactions. The flow stress values depend on the obstacle sizes and spacings, over and above the usual 1/L dependence, where L is the average obstacle spacing. The main effects of the self-interactions are captured in a line tension analog in which the obstacles are penetrable. ERA

N77-20167# Purdue Univ., Lafayette, Ind.

THE ENZYME-CATALYZED SYNTHESIS OF SUCROSE FROM STARCH Progress Report

Susan J. Kelly, Larry G. Butler, and Robert G. Squires 18 May 1976 7 p refs (Grant NSF APR-73-07773) (PB-259173/3; NSF/RA-760225) Avail: NTIS HC A02/MF A01 CSCL 07A

Sucrose synthesis from starch is described: (1) by the reversal of the invertase reaction to condense glucose and fructose mixtures present in high fructose syrups using nonaqueous solvents to replace most of the solvent water and shift the equilibrium toward sucrose synthesis; and (2) by the phosphate process, in which the synthesis of sucrose is catalyzed by sucrose phosphorlase from alpha-D-glucose-1-phosphate and fructose. Of the two approaches to sucrose synthesis from starch, the phosphate process appears to have the most merit. It may provide an alternate domestic source of sucrose. The cost of the high fructose syrup is presently 9 cents/lb. and that of sucrose is 17-18 cents/lb. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N77-20168*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FRICTION AND WEAR BEHAVIOR OF GRAPHITE FIBER REINFORCED POLYMIDE COMPOSITES

Robert L. Fusaro and Harold E. Sliney 1977 22 p refs Proposed for presentation at the Ann. Lubrication Meeting of the Am. Soc. of Lubrication Engr., Montreal, 9-12 May 1977 (NASA-TM-X-73565; E-9012) Avail: NTIS HC A02/MF A01 CSCL 11D

The friction and wear rate characteristics of 50/50 (weight percent) graphite fiber polyimide composites were studied by sliding metallic hemispherically tipped riders against disks made from the composites. Two different polyimides and two different graphite fibers were evaluated. Also studied were such variables as the effect of moisture in an air atmosphere; the effect of temperature; and the effect of different sliding speeds. In general, wear to the the metallic riders was negligible, and composite wear increased at a constant rate as a function of number of sliding cycles. Author

N77-20169*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONCEPTS FOR THE DEVELOPMENT OF LIGHT-WEIGHT COMPOSITE STRUCTURES FOR ROTOR BURST CONTAINMENT

Arthur G. Holmes 1977 34 p refs Proposed for presentation at the NASA Workshop on an Assessment of Technol. for Turbojet Engine Rotor Failures, Cambridge, Mass., 29-31 Mar. 1977
(NASA-TM-X-73633; E-9129) Avail: NTIS HC A03/MF A01 CSCL 11D

A set of hypotheses is established as to what variables might control the design of a weight-efficient protective device. A particular experiment for evaluating the hypotheses and materials was designed. The design and methods for the analysis of results are described. Author

N77-20170# Oak Ridge National Lab., Tenn.
THEORETICAL AND EXPERIMENTAL DETERMINATION OF MECHANICAL PROPERTIES OF SUPERCONDUCTING COMPOSITE WIRE

W. H. Gray and C. T. Sun Jul. 1976 52 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5331) Avail: NTIS HC A04/MF A01

For a particular composite superconducting wire, five elastic material constants were experimentally determined and theoretically calculated. Since the Poisson's ratios for the fiber and the matrix material were very close, there was essentially no (less than 1 percent) difference among all the thoeretical predictions for any individual mechanical constant. Because of the expense and difficulty of producing elastic constant data of 0.1 percent accuracy, and therefore conclusively determining which theory is best, no further experiments were performed. ERA

N77-20171# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Fabrication and Product Development Dept.
DETERMINATION OF FLATWISE TENSILE STRENGTH OF VARIOUS HONEYCOMB/CFRP SANDWICH CONFIGURATIONS

L. M. Godfried 9 Sep. 1976 16 p
(FOK-R-2048) Avail: NTIS HC A02/MF A01

The values of flatwise tensile strength of various honeycomb/CFRP (carbon fiber reinforced plastics) sandwich configurations were determined from tensile tests. A 30% lower ultimate strength was determined for epoxy adhesive/glass fabric (5.677/1) compared with epoxy adhesive film 5.917/2 on heavy aluminum honeycomb type 5.453/4. All flatwise tensile strength tests carried out with epoxy adhesive/Kevlar fabric (5.685/1) on Nomex core and low density aluminum core showed core failure.
Author (ESA)

N77-20172# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Manufacturing and Product Development Dept.
INVESTIGATION INTO THE QUALITY OF CARGO COMPARTMENT LINING MATERIAL GILLINER 1102

W. Nieland 23 Sep. 1976 26 p
(FOK-R-2051) HC A03/MF A01

From Gilliner 1102 (glass fiber reinforced phenolic resin) cargo compartment lining material the chemical resistance against Skydrol 500 B and JP1 was determined. The material was submitted to smoke emission tests (NPRM75-3), flammability and self extinguishing tests (FAR 25583 appendix F), and impact tests (Ref. R-766). In addition the weight per square meter and the glass content (%) by weight were determined. It can be concluded that Gilliner 1102 is suitable lining material for the cargo compartment of the F-28. Author (ESA)

N77-20173# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
APPLICATIONS ORIENTED BASIC RESEARCH OF HYBRID MATERIALS [ANWENDUNGSORIENTIERTE GRUNDLAGENUNTERSUCHUNGEN AN HYBRIDWERKSTOFFEN]

O. Kabilka Bonn DOKZENTBW 1976 100 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung Original contains color illustrations
(BMVG-FBWT-76-8) Avail: NTIS HC A05/MF A01; DOKZENTBW DM 30

With the purpose of improving the energy absorption capacity and damping behavior of high modulus fiber reinforced composites, carbon fiber and boron fiber reinforced plastics were mixed with glass fibers and Kevlar fibers. The elastic properties of these fiber hybrid materials, the interlaminar shear strength and the behavior of thermal expansion of unidirectional laminates were ascertained by calculation and testing and are shown in diagrams. The ternary diagrams allow definition of the elastic properties of fiber hybrid materials at any combination of the initial materials mentioned above. Results of the damping and impact tests show the expected improvement of the properties of hybrid materials compared with the one-fiber materials.
Author (ESA)

N77-20174# Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF SELF-LUBRICATING COMPOSITES UTILIZING CARBONIZED PHENOLIC MATRIX. PART 2: A SUMMARY REPORT Final Technical Report, 1 Aug. - 31 Dec. 1975

Melvin T. Lavik and Vern Hopkins Apr. 1976 86 p refs
(Contract F33615-75-C-5101; AF Proj. 7343; MRI Proj. 4014-E)
(AD-A031009; AFML-TR-75-175-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 11/8

Exploratory development and evaluation have been conducted on self-lubricating composites which utilize a carbonized phenolic resin (CPR) matrix. Composites have been prepared with as much as 59% (vol.) graphite fibers. Specimens have been compression-molded directly as journal liners within a metal housing or as blanks which can be machined into desired test configurations. Additives such as Sb_2O_3, ZnO, and tetrafluoroethylene powders have provided beneficial synergistic effects within the CPR-MoS_2-fiber composites. Screening friction and wear tests have been conducted at various loads and speeds. The composites with approximately 30 vol % fiber performed better at the high loads than those with lower fiber content. Oscillatory journal bearing tests have been conducted at loads from 2,000 to 12,000 psi at an average linear speed of 2.18 fpm (0.011 m/s) and at temperatures of 100, 400, and 600 F (311, 477, and 588 K). The composites containing 31% fibers exhibited much better wear resistance than composites with 18% fiber content. GRA

N77-20175# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
ALUMINA SUBSTRATE ASSEMBLY STUDY Final Report

James H. Richardson 1 Oct. 1976 84 p refs
(Contract F04701-76-C-0077)
(AD-A032177; SAMSO-TR-76-214; TR-0077(2724-01)-01) Avail: NTIS HC A05/MF A01 CSCL 09/5

The potential exists for intermittent electrical failures as the result of the various mission environments experienced by the alumina substrate assemblies (ASAs) used in FLTSATCOM. To explore this possibility, a test program was devised in which samples of the ASA technology were subjected to a series of monitored vibration, mechanical shock, and thermal cycle environments that approximated those of the mission. The tests indicated that no failures could be directly attributed to the alumina substrate. Those few failures that did occur were more adequately explained in terms of other failure mechanisms. Therefore, it would appear that the ASA is a viable medium for FLTSATCOM modules when subjected to environments within the range of this study. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N77-20176 Engineering Sciences Data Unit, London (England).
VAPOUR PRESSURES AND CRITICAL POINTS OF LIQUIDS. 9: C2 TO C11 ALIPHATIC ETHERS AND THREE AROMATIC ETHERS

Oct. 1976 29 p
(ESDU-76024; ISBN-0-85679-161-X) For information on availability of series, sub-series, or individual data items, write

NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

Saturated vapor pressures in both tabular and graphical form of the ethers are presented. All quantities are expressed in SI units, in this case kN sq m and kelvins, but for users who require them in mmHg and C some data are given in these units, and conversion factors to other units are provided. The procedures used to derive the values of vapor pressure are presented. The values of vapor pressure given in the tables were obtained by evaluating, for each compound, an equation in the form of a series of Chebyshev polynomials fitted to the selected or estimated data. Dissert. Abstr.

N77-20177 Engineering Sciences Data Unit, London (England).
VAPOUR PRESSURES AND CRITICAL POINTS OF LIQUIDS. 10: C1 TO C18 ALIPHATIC AMINES Data Item
Oct. 1976 33 p
(ESDU-76025; ISBN-0-85679-162-8) For information on availability series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

Saturated vapor pressures in both tabular and graphical form of the amines are presented. The data on which the values in the tables are based are the most reliable available and were fitted and correlated by equations that are valid from the melting temperature upwards over the whole liquid range. All quantities are expressed in SI units, in this case kN sq m and kelvins, but for users who require them in mmHg and C some data are given in these units, and conversion factors to other units are provided. The procedures used to derive the values of vapour pressure are presented. The values of vapour pressure given in the tables were obtained by evaluating, for each compound, an equation in the form of a series of Chebyshev polynomials fitted to the data that were selected and weighted in accordance with a critical assessment of all the data. Dissert. Abstr.

N77-20178 Polish Academy of Sciences, Warsaw.
CHEMICAL CROSS-LINKING OF POLYETHYLENE [CHEMICZNE SIECIOWANIE POLIETYLENU]
Krzystof A. Kunert 18 Jun. 1976 40 p refs In POLISH
Copyright. Avail: Issuing Activity

Chemical crosslinking of polyethylene is achieved with the use of organic peroxides. Transformation methods and crosslinking compounds are discussed. Cross-linked polyethylene has better thermal, physical, electrical, and mechanical properties than does natural polyethylene, making it a valuable insulation material for electric cable. These characteristics are detailed. Crosslinked polyethylene has a few negative characteristics compared with other insulators: (1) it requires very precise temperature regulation in moulding with an exactness up to 1 C, and disconnection must proceed very slowly; (2) crosslinked polyethylene cable is less pliable than cable coated with other thermoplastic insulators; and (3) crosslinked polyethylene is not a nonflammable material, as is polyvinyl chloride, which is used in jackets as a fire safeguard. Author

N77-20179*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE TEMPERATURE DEPENDENCE OF THE REACTIONS OF HO2 WITH NO AND NO2
R. Simonaitis and Julian Heicklen 7 Mar. 1977 43 p refs
(Grants NGL-39-009-003; NGR-39-009-003; NSF GA-42856)
(NASA-CR-149898; PSU-IRL-SCI-454) Avail: NTIS HC A03/MF A01 CSCL 07D

Mixtures of N2O, H2, O2 and trace amounts of NO and NO2 were photolyzed at 213.9 nm at 245-328 K and about 1 atm total pressure (mostly H2). HO2 radicals are produced from the photolysis, and their reactions are reported. Author

N77-20180# California Univ., Berkeley. Lawrence Berkeley Lab.
STRUCTURE AND ELECTRICAL PROPERTIES OF GLASS CARBON Ph.D. Thesis
19 Jun. 1976 168 p refs
(Contract W-7405-eng-48)
(LBL-5129) Avail: NTIS HC A08/MF A01

Glassy carbon (GC) samples were heat treated at 1000 to 2800 C for different times to produce structural changes. Comparison of K emission bands of graphite, diamond, and GC shows that GC may consist of both trigonally and tetrahedrally bonded C atoms, with the tetrahedral content decreasing with temperature. Single crystal patterns are seen in transmission electron microscope studies. The interlayer spacing d sub 002 is reduced only to 3.40A deg for GC heat treated at 2800 C for two hours (GC 2800-2). The crystallite size parameters L/sub c/, L/sub a/ (perpendicular and parallel to graphite layers) grow only to 28 and 50A respectively for GC 2800-2. Based upon the heat treatment variation of d sub 002 L/sub c/, and L/sub a/, three different temperature regions are found. Author (ERA)

N77-20181# Atlantic Richfield Hanford Co., Richland, Wash.
DETERMINATION OF HYDROXIDE IN THE PRESENCE OF ALUMINATE USING A MODIFIED POTENTIOMETRIC TITRATION
Terry J. Hanson Nov. 1975 25 p refs
(Contract E(45-1)-2130)
(ARH-ST-108) Avail: NTIS HC A02/MF A01

A procedure for the determination of hydroxide concentration in the presence of aluminate and other interfering ions was developed using the method of standard additions (or more specifically in this case, standard subtractions). The procedure called for titration with a strong acid which was added in equal increments at regular time intervals. The potential was recorded after each addition of acid. The data were plotted on Gran's Plot Paper, or it was entered into a computer to determine the equivalence volume of the titrant. When used on many different samples in different matrices, the method gave results that were approximately 100 + or - 1 percent of the calculated value. The method is applicable to radioactive as well as nonradioactive samples, and any heat involved with a radioactive sample is insufficient to cause an error in the determination. ERA

N77-20182# Mound Lab., Miamisburg, Ohio.
DETERMINATION OF CHLORATE IN POTASSIUM PERCHLORATE PYROTECHNIC MATERIAL BY SPECIFIC ION ELECTRODE
W. G. Yates 31 Aug. 1976 12 p refs
(Contract E-33-1-gen-53)
(MLM-2322) Avail: NTIS HC A02/MF A01

A method for the determination of chlorate ion in potassium perchlorate was developed. The analytical method utilized a reduction of the chlorate ion to the chloride ion with ferrous ammonium sulfate. The chloride ions produced by this reduction step were then determined with a specific ion electrode technique. The amount of chlorate ion was determined by calculating how much chlorate ion was represented by the analyzed chloride ion making an appropriate adjustment for the amount of free chloride ion found in the potassium perchlorate and deionized water. ERA

N77-20183# Washington Univ., Seattle. Dept. of Chemistry.
ANALYSIS OF ATMOSPHERIC ORGANIC AEROSOLS BY MASS SPECTROSCOPY Final Report, Jun. 1972 - Oct. 1975
Alden L. Crittenden Aug. 1976 296 p refs
(Grant EPA-R-801119)
(PB-258822/6; EPA-600/3-76-093) Avail: NTIS HC A13/MF A01 CSCL 14B

Compounds that were detected included phenols; aromatic carboxylic acids and, possibly, esters of these; and aliphatic dibasic acids. Evidence was found of several other difunctional compounds, including nitrate or nitrite species. Strong evidence was found for the presence in some urban aerosols of compounds reported by others as products of the oxidation of toluene in smog chamber reactions. Less evidence was found for products formed by the oxidation of terpenes. A few samples of automobile exhaust particulates were analyzed. The occurrence of benzoic acid and the benzoyl ion in mass spectra appear to be possible indicators of automotive contribution to the organic components. Results for a large number of compounds are provided for 88 samples of aerosols collected at sites located in the greater Los Angeles, Seattle, St. Louis, and Denver areas. GRA

N77-20184# Catholic Univ. of America, Washington, D.C. Center for Molecular Dynamics and Energy Transfer.
CHEMICAL REACTIONS Final Report, 1 Apr. 1973 - 1 Jul. 1976

Richard B. Timmons and William A. Sanders 31 Aug. 1976 52 p refs
(Contract N00014-75-C-0839; RR0110302)
(AD-A030321; N-76-B) Avail: NTIS HC A04/MF A01 CSCL 07/4

Energy distributions of the product diatoms HX were measured experimentally for reactions of the type F + H-R and H + Cl-R prime. The measurements were made in a low-pressure, coldwall flow reactor in which unrelaxed vibrational distributions could be observed readily. The product energy distributions were related to the structural features of the substrate molecules and some tentative generalizations formulated. The reaction F + (CH3)2CHOH produced unusually intense chemiluminescence which originated primarily from the u = 2 level of HF. The theoretical efforts aimed at discovering any general relationships between the structure of the substrate molecule and the product energy distribution. Analysis of all available literature data plus those obtained here revealed that the percent of the exothermicity deposited into vibrations of the product diatom decreased linearly as the delta H of the reaction increased. A possible interpretation of this observation in terms of the potential energy surface is discussed. Author (GRA)

N77-20185# Army Medical Intelligence and Information Agency, Washington, D.C.
THE SOLUBILITY OF SEVERAL AROMATIC HYDROCARBONS IN WATER
A. N. Guseva and Ye. I. Parnov 19 Aug. 1976 5 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. II. Khim. (USSR), v. 18, no. 1, 1963 p 76-78
(AD-A029649; USAMIIA-K-6467) Avail: NTIS HC A02/MF A01 CSCL 07/4

In order to solve a number of theoretical problems in petroleum geology, for example, the formation and disintegration of agglomerates, as well as certain practical problems in the area of petroleum refining, water pollution, etc., information is needed regarding the solubility of hydrocarbons in various types of natural solutions under various conditions. Existing literature data on the solubility of hydrocarbons, even in pure water, are quite meager. There is especially little material on the solubility of hydrocarbons in water at the high temperatures which can occur at great depths. In the study reported here benzene, toluene, o-xylene, m-xylene, n-xylene and mesitylene were used; the criterion of purity was the index of refraction. Especially pure water was obtained by passing a double distillate through a filter with a 'mixed' layer consisting of ion-exchange resins EDE-10P and KU-2. The solubilities of the aromatic hydrocarbons in water was determined in sealed ampules by the polythermic method. As is evident from graphs, the solubility curves have an extremely similar character, with the exception of benzene whose curve shape is slightly different from the other hydrocarbons. The solubility of hydrocarbons increases intensely with temperature and decreases as the number of methyl groups in the molecule is increased. As the critical point is approached the curves of different hydrocarbons show a tendency to converge; as with increase of temperature the solubility depends all the more on the structural properties of the water. Also the role of the structure of hydrocarbon molecules, including the number and location of methyl groups, is increasingly weaker. GRA

N77-20186# Arizona Univ., Tucson. Dept. of Physics.
DOPPLER-SHIFTED REFLECTIONS OF X-RAYS IN BEAM-FOIL SPECTROSCOPY
E. M. Bernstein and L. C. McIntyre, Jr. 1976 8 p refs
(Contract N00014-75-C-0499; NR Proj. 393-017)
(AD-A030076) Avail: NTIS HC A02/MF A01 CSCL 07/4

In a conventional beam-foil spectroscopy experiment, radiation from an ion beam is viewed by a spectrometer after the beam has passed through a thin foil. The plane of the foil is usually perpendicular to the ion beam, and the radiation accepted by the spectrometer is emitted in a small range of angles centered about 90 deg. relative to the beam direction. In order to investigate short-lived atomic states excited by the foil, one must view the beam very close to the foil. In a recent experiment, we 'tilted' carbon foils by about 10 deg. relative to the usual perpendicular position to insure that the spectrometer would view the beam as it emerged from the foil, and that no radiation could be shielded by a bowed or wrinkled foil or by the foil holder. We report here the observation of extraneous peaks due to reflected radiation in the spectrum obtained with a 'tilted' foil. GRA

N77-20187# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CROSS SECTION MEASUREMENTS FOR PHOTODETACHMENT OR PHOTODISSOCIATION OF IONS PRODUCED IN GASEOUS MIXTURES OF O2, CO2, AND H2O
R. A. Beyer and J. A. Vanderhoff Sep. 1976 42 p refs
(DNA Proj. NWED-QAXHD010)
(AD-A030187; BRL-1922) Avail: NTIS HC A03/MF A01 CSCL 07/4

A drift tube mass spectrometer coupled with a continuous laser photon source has been used to study photodissociation of thermal energy positive ion clusters. Absolute photodissociation cross sections have been measured for the singly charged positive ion of molecular oxygen clustered to one and two water molecules, clustered to molecular oxygen, and clustered to one carbon dioxide molecule. Upper limits have been established for the photodissociation cross sections of the atomic hydrogen positive ion clustered to one through four water molecules. All of these measurements have been made at room temperature and for low field conditions (10 or 14.3 x 10(-21) volt-square meter). Photon wavelengths ranging from 676.4 nm to 454.4 nm were studied. The hydrated proton clusters were found to have small or zero cross sections. The single molecules of water and carbon dioxide clustered to the molecular oxygen cation have cross sections which behave similarly over part of the photon energy range. Near 2.60 eV both ions have cross sections approaching 6 x 10 (-22) square meter. The photodissociation of the molecular oxygen cation-carbon dioxide cluster produces a singly charged carbon dioxide cation photofragment. From the appearance of the fragment an upper bound on the dissociation energy of the molecular oxygen ion cluster to carbon dioxide was placed at 0.46 eV. Author (GRA)

N77-20188# Naval Postgraduate School, Monterey, Calif.
EQUILIBRIUM AND KINETICS OF SOME SIMPLE COMPLEXES OF PALLADIUM 2 Final Report, 1 Jul. 1958 - 30 Jun. 1976
Richard A. Reinhardt and Kenneth J. Graham 15 Jul. 1976 55 p refs
(RR0000110)
(AD-A030089; NPS-61RI76071) Avail: NTIS HC A04/MF A01 CSCL 07/4

Fifteen years of studies on Palladium(II) complexes of H2O, NH3, and Cl(-) are summarized, including not only results from this laboratory but also from other laboratories, as have appeared in the chemical literature. More extensive report is given on several experiments not appearing elsewhere: the isomerism equilibria of Pd(NH3)2Cl2 and the ammoniation kinetics of cis-Pd(NH3)2Cl2. Tables are given for all presently known equilibrium and kinetic data involving these complexes, and estimates are also provided for a number of reactions for which no data exist. Thirty-eight references are cited. GRA

N77-20189# Ballistic Research Labs., Aberdeen Proving Ground, Md.
VALUES FOR SELECTED COLLISIONAL DISSOCIATION RATE COEFFICIENTS OF POSITIVE CLUSTERED IONS Final Report
J. M. Heimerl Aug. 1976 40 p refs Supersedes IMR-499
(DA Proj. 1T1-62111-AH-71)
(AD-A029634; BRL-1917; IMR-499) Avail: NTIS HC A03/MF A01 CSCL 07/4

Values of the rate coefficient, k sub r, for 15 gas-phase, two-body, collisional-dissociation reactions involving positive cluster ion of aeronomic interest were tabulated. These values were cast into the form k sub r = A (T/300) B exp (C/T). Where possible, error bounds for the constants A, B and C were estimated. GRA

N77-20190# Utah Univ., Salt Lake City. Dept. of Chemistry.
ULTRASONIC ABSORPTION KINETIC STUDIES OF THE COMPLEXATION OF AQUEOUS Li(+), Na(+), Rb(+), Tl(+), Ag(+), NH(4)+, AND Ca (SUPER 2)(+) BY 18-CROWN-6.
Gerard W. Liesegang, Michael M. Farrow, F. Arce Vazquez, Neil

Purdie, and Edward M. Eyring 1 Sep. 1976 22 p refs
(Contract N00014-75-C-0796; NR Proj. 051-556)
(AD-A029675; TR-8) Avail: NTIS HC A02/MF A01 CSCL 07/4

The complexation-decomplexation reaction kinetics of the macrocyclic polyether 18-crown-6 (1,4,7,10,13,16-hexaoxacyclooctadecane) with the aqueous cations Li(+), Na(+), Rb(+), Tl(+), Ag(+), NH4(+) and Ca(2+) have been determined from acousto-optic ultrasonic absorption data covering the 15-205 MHz frequency range, at 25C. These data, together with a previously reported crown ether conformational change, were analyzed in terms of a multistep mechanism that admits the possibility of water loss or conformational changes but not diffusion as being rate limiting. The complexation rate constants follow the trend Ca(2+) then Li(+) - Na(+) - K(+) then Cs(+) then Rb(+) NH4(+) - Tl(+) - Ag(+). GRA

N77-20191# Wisconsin Univ., Madison. Mathematics Research Center.
DISCOVERY OF REACTION SEQUENCES FOR THERMOCHEMICAL WATER SPLITTING
D. May and D. F. Rudd Jun. 1976 36 p refs presented at 1st World Hydrogen Energy Conf., 1-3 Mar. 1976
(Contract DAAG29-75-C-0024)
(AD-A029959; MRC-TSR-1636) Avail: NTIS HC A03/MF A01 CSCL 07/4

Waste heat from nuclear reactors could be used to generate hydrogen fuel from water if the proper sequence of thermochemical reactions can be discovered. The authors develop methods for the discovery of thermodynamically and stoichiometrically feasible reaction sequences. This leads towards a graph theory of reaction sequence synthesis. GRA

N77-20192# Hunter Coll., New York. Dept. of Chemistry.
INTERACTION OF SMALL MOLECULES WITH LIQUID CRYSTALS: A SPECTROSCOPIC STUDY Final Report
Bernard J. Bulkin 16 Aug. 1976 96 p refs
(Grants DA-ARO(D)-31-124-70-G22; DA-ARO(D)-31-124-73-G97)
(AD-A029404; ARO-8646.10-C) Avail: NTIS HC A05/MF A01 CSCL 07/4

Infrared and Raman spectroscopy have been used to investigate the interaction of a variety of small molecules with liquid crystals. The systems studied include cholesteric, nematic, and smectic liquid crystals of both the thermotropic and lyotropic types. These results lead to an understanding of structure of liquid crystals and how this structure is perturbed by solutes. They also indicate that solutes may be used to aid in measuring order in liquid crystals. A useful application of these studies, a liquid crystal based fractionator for the detection and identification of a wide variety of molecules in the vapor phase, is presented. This device can be used as a gas chromatograph detector or, more suitably, as a detector/fractionator in a gas chromatograph-infrared spectrometer effluent on-the-fly analyzer. Here the cholesteric liquid crystal color change is used as the detector, and the infrared spectrum provides positive identification. This system can also be used to detect and identify minor components in an air stream. Author (GRA)

N77-20193# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.
HETEROGENEOUS SENSITIZED DECOMPOSITION OF WATER WITH SUNLIGHT Final Progress Report, 1 Jul. 1975 - 30 Jun. 1976
Amal K. Ghosh and H. Paul Maruska 30 Jun. 1976 66 p refs
(Grant NSF ERP-75-13901)
(PB-258870/5; EXXON/GRU.4BEA.75; NSF/RA-760239) Avail: NTIS HC A04/MF A01 CSCL 07E

Studies of the sensitization of TiO2 electrodes to visible light to achieve the photoelectrolysis of water with sunlight were undertaken. Sensitization was accomplished by: (1) impurity doping; (2) dye sensitization; and (3) heterojunction formation. Hydrogen gas was generated in photoelectrolysis cells with visible light using both Cr-doped TiO2 and TiO2/CdSe heterojunction electrodes. Photocurrents in response to visible excitation were observed with a number of dyes. Quantum efficiencies as high as 100% were achieved with UV excitation (360nm) of Al-doped TiO2 electrodes, which have a sunlight engineering efficiency of 0.75%. Hydrogen was produced by UV excitation of SrTiO3 without an external bias. GRA

N77-20194# Utah Univ., Salt Lake City. Dept. of Chemistry.
KINETIC STUDIES OF THE COMPLEXATION OF MONOVALENT SODIUM, POTASSIUM, RUBIDIUM, THALLIUM AND SILVER CATIONS BY AQUEOUS 15-CROWN-5
Licesio J. Rodriguez, Gerard W. Liesegang, Robert D. White, Michael M. Farrow, and Neil Purdie 4 Oct. 1976 33 p refs
(Contract N00014-75-C-0796; NR Proj. 051-556)
(AD-A031272; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/3

A kinetic study of the rapid conformation equilibrium of aqueous 15-crown-5 (1,4,7,1+,13-pentaoxacyclopentadecane) and of its complexation of monovalent sodium, potassium, rubidium, thallium and silver cations at 25 deg in aqueous solution has been carried out by ultrasonic absorption in the 15 to 205 MHz frequency range. A concentration independent absorption with a maximum at 22.9 + or - 0.5 MHz detected in aqueous solutions of 15-crown-5 with no cations added has been attributed to a conformational rearrangement of the crown ether. The kinetics of the complexation of the polyether with sodium, potassium, rubidium, silver and thallium(I) ions were then investigated at various polyether and metal concentrations with concentration dependent relaxations occurring between approx. 20 and approx. 50 MHz. These data, together with the conformational rearrangement data, were analyzed in terms of a two step mechanism with CR(1) rearranging to CR(2) and CR(2)+ M(+) rearranging to a complex in which CR(2) denotes the conformation of the ether which participates in the complexation reaction. GRA

N77-20195# National Bureau of Standards, Washington, D.C.
METALLO-ORGANIC SYSTEMS WITH HIGH THERMAL STABILITY
Emanuel Horowitz 13 Jun. 1967 15 p refs Repr. from Advan. in Chem. Ser., paper 7, no. 85, 1968 p 82-94
(PB-259057/8; Paper-7) Avail: NTIS HC A02/MF A01 CSCL 07C

When 8-hydroxyquinoline and derivates of bis(8-hydroxyguinoline) react with metal ions, coordination complexes and polymers are formed, respectively, which exhibit improved thermal stability. The reaction of first row transition metal ions with such ligands and their effect on the stabilization of these organic molecules are reviewed. For the polymers containing divalent Mn, Co, Ni, Cu, or Zn the decomposition temperature is related to the periodic properties of the metal as well as the composition of the ligand to which the metal is coordinated. Trivalent chromium produces a crosslinked polymer when it reacts with bis(8-hydroxy-5-quinolyl)methane, and the thermogram for this polymer is also reported. GRA

N77-20196# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
EVALUATION OF NONISOTHERMAL BAND MODELS FOR H2O Interim Report
Stephen A. Young 1 Oct. 1976 45 p refs
(Contract F04701-76-C-0077; ARPA Order 2843)
(AD-A031175; TR-0077(2753-04)-2; SAMSO-TR-76-209) Avail: NTIS HC A03/MF A01 CSCL 20/6

Comparisons of predicted and measured radiance spectra for nonuniform hot H2O gas samples are reported. The predicted spectra are generated with band models formulated in a companion paper, and band model parameters constructed to handle optical path temperature variations from 200 to 3000 K. The model identified in the companion paper as the intuitive derivative approximation is shown to be superior to the traditional Curtis-Godson approximation in treating general optical paths along which high degrees of nonuniformity occur. Author (GRA)

N77-20197# Bureau of Mines, Amarillo, Tex. Helium Operations.
ANALYSIS OF NATURAL GASES, 1975 Information Circular 1976
B. J. Moore Sep. 1976 88 p refs
(PB-259351/5; BM-IC-8717) Avail: NTIS HC A05/MF A01 CSCL 21D

Analyses and related source data for 234 natural gas samples from wells and pipelines in 21 states and one foreign country are presented. These samples were collected during 1975 as a part of the Bureau of Mines investigations of the occurences of helium. GRA

N77-20198# Oregon State Univ., Corvallis. School of Oceanography.
A DYNAMIC PARTIAL ORDER MODEL OF ELECTROLYTE SOLUTIONS
R. M. Pytkowicz, K. Johnson, and C. Curtis Oct. 1976 125 p refs
(Contract N00014-76-C-0067)
(AD-A031316; Ref-76-13) Avail: NTIS HC A06/MF A01 CSCL 07/4

The purpose of this work was to develop a dynamic partial order model of electrolyte solutions which avoids inconsistencies present in the Debye-Huckel and in related theories. It is shown that our results are consistent with activity coefficient data in aqueous electrolyte solutions. The main features of our work are a partial long-range order which increases with concentration due to the increase in the coulombic energy of interaction and decreases with temperature, a contribution from ionic fluctuations because it is shown that displacements from average positions lead to a symmetric increase in energy which is not cancelled out, and a hydration correction for the effect of hydration upon the effective ionic concentrations. Ions are given partial counter-ion character as a function of the degree of order so that the free energy of ionic interactions can be calculated rigorously, as if the lattice were perfect, without resort to cluster integrals in the case of single salt solutions. Author (GRA)

N77-20199# New Orleans Univ., La. Dept. of Chemistry.
ANALYSIS BY FLAMELESS ATOMIC ABSORPTION Annual Report, 1 Jun. 1975 - 31 May 1976
Charles L. Yuan, Judy V. Chauvin, John F. Molina, Mike H. West, and Donald G. Davis 20 Oct. 1976 122 p refs
(Contract DAMB17-75-C-5048)
(AD-A032016; Rept-357-30-5105; AR-1) Avail: NTIS HC A07/MF A01 CSCL 07/4

Techniques for the analysis of trace metals in natural waters as well as other samples of biological and environmental interest by flameless atomic absorption spectrometry have been developed. Aqueous standard and unknown solutions are applied to a tungsten-rhenium wire loop atomizer, which can be electrically heated. Employing pure aqueous standards, peak height absorbance was utilized as a measure of the transient atomic absorption signal in order to establish calibration curves for zinc, iron, chromium, silver, manganese, cadmium, copper, and lead. Natural water samples, provided by the United States Army Environmental Hygiene Agency, have been analyzed for these metals. The results obtained from the wire loop aliquot method are compared to those found by 'referee' analysis techniques -- flame and nonflame atomic absorption spectrometry. Any interferences arising from the presence of transition metal salts or the sodium salts of various common anions, each at a concentration of ca. 10/3M, in 1.0 ppm solutions of the above metals are reported and evaluated. GRA

N77-20200# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
FREE ENERGIES OF FORMATION OF CHROMOUS, CHROMIC, AND CHROMIUM (II, III) FLUORIDES BY ELECTROMOTIVE FORCE MEASUREMENTS
Seth C. Schaefer Sep. 1976 25 p refs
(PB-259391/1; BM-RI-8172) Avail: NTIS HC A02/MF A01 CSCL 07D

Gibbs free energies of formation for CrF2, CrF3, CrF2.40, and CrF2.45 were determined with the aid of high-temperature galvanic cells, employing calcium fluoride doped with 1 mole-pct yttrium fluoride, as the solid electrolyte. Equations representing the Gibbs free energies of information as a function of temperature are given for each phase. Values obtained for Gibbs free energies of formation from the elements at 900K are minus 157.41 plus or minus 187.57 plus or minus 0.80cal respectively, per mole of CrF2, CrF3, CrF2.40, and Cr2.45. Gibbs free energies and corresponding fluorine dissociation pressures for three univariant equilibria of the Cr-F system are tabulated and illustrated for the 900K isotherm. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-20201* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ZIRCONIUM MODIFIED NICKEL-COPPER ALLOY Patent
John D. Whittenberger, inventor (to NASA) Issued 15 Mar. 1977 5 p Filed 5 Jun. 1975 Supersedes N75-26087 (13 - 17, p 2086)
(NASA-Case-LEW-12245-1; US-Patent-4,012,237; US-Patent-Appl-SN-584094; US-Patent-Class-148-2; US-Patent-Class-75-170; US-Patent-Class-148-12.7N; US-Patent-Class-148-20.3; US-Patent-Class-148-32.5; US-Patent-Class-148-162) Avail: US Patent Office CSCL 11F

An improved material for use in a catalytic reactor which reduces nitrogen oxide from internal combustion engines is in the form of a zirconium-modified, precipitation-strengthened nickel-copper alloy. This material has a nominal composition of Ni-30 Cu-0.2 Zr and is characterized by improved high temperature mechanical properties. Official Gazette of the U.S. Patent Office

N77-20202# Aeronautical Research Labs., Melbourne (Australia).
THE INFLUENCE OF THE WATER VAPOUR CONTENT AND THE TEMPERATURE OF AN AIR ENVIRONMENT ON THE FATIGUE BEHAVIOUR OF SAE 4340 STEEL
D. S. Kemsley Aug. 1976 27 p refs Proposed for presentation at ARL Symp. on Aircraft Structural Fatigue
(ARL/Struc-TM-250; ICAF-702) Avail: NTIS HC A03/MF A01

Total fatigue lives, fatigue crack initiation and propagation lives, and fatigue crack propagation rates of notched SAE 4340 steel specimens under program loading are determined in air environments having forty five different water vapor content/temperature combinations. Forty three of these involved unsaturated (less than 100% RH) conditions. As the temperature of air of constant water vapor content is lowered, and the conditions change from an unsaturated to a saturated (100% RH, for) environment, a marked reduction in fatigue life occurs. This is due to the combination of a decrease in crack initiation life and a large increase in the rate of crack propagation. The bearing of the results on the common concepts of corrosion fatigue and atmospheric corrosion fatigue is discussed. Author

N77-20203*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NEW APPLICATIONS OF SPUTTERING AND ION PLATING
Talivaldis Spalvins 1977 26 p refs Proposed for presentation at the Design Eng. Conf., Chicago, 9-12 May 1977; Sponsored by ASME
(NASA-TM-X-73551; E-8989) Avail: NTIS HC A03/MF A01 CSCL 11F

The potential industrial applications of sputtering and ion plating are strictly governed by the unique features these methods possess. The outstanding features of each method, the resultant coating characteristics and the various sputtering modes and configurations are discussed. New, more complex coatings and deposits can be developed such as graded composition structures (metal-ceramic seals), laminated and dispersion strengthened composites which improve the mechanical properties and high temperature stability. Specific industrial areas where future effort of sputtering and ion plating will concentrate to develop intricate alloy or compound coatings and solve difficult problem areas are discussed. Author

N77-20204*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FERROGRAPHIC ANALYSIS OF WEAR DEBRIS GENERATED IN A SLIDING ELASTOHYDRODYNAMIC CONTACT
William R. Jones, Jr., H. S. Nagaraj (Ga. Inst. of Tech.), and

Ward O. Winer (Ga. Inst. of Tech.) 1977 27 p refs Proposed for presentation at Ann. Meeting of the Am. Soc. of Lubrication Engr., Montreal, 9-12 May 1977
(NASA-TM-X-73585; E-8925) Avail: NTIS HC A03/MF A01 CSCL 11F

The ferrograph was used to analyze wear debris generated in a sliding elastohydrodynamic contact. The amount of wear debris correlates well with the ratio of film thickness to composite surface roughness. Essentially all of the generated wear particles were of the normal rubbing wear type. Author

N77-20205*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VOLATILE PRODUCTS IN THE CORROSION OF Cr, Mo, Ti AND FOUR SUPERALLOYS EXPOSED TO O2 CONTAINING H2O AND GASEOUS NaCl
George C. Fryburg, Robert A. Miller (NAS-NRC), Fred J. Kohl, and Carl A. Stearns 1977 21 p refs Proposed for presentation at the Symp. on Corrosion Probl. Involving Volatile Corrosion Products, Philadelphia, 8-13 May 1977; sponsored by Electrochem. Soc.
(NASA-TM-X-73599; E-9074) Avail: NTIS HC A02/MF A01 CSCL 11F

Cooled target collection techniques were used to study the formation of volatile products when samples of Cr, Ti, IN-738, 713C, NASA-TRW VIA and B-1900 were exposed, at elevated temperatures, to oxidizing environments containing H2O(g) and NaCl(g). Samples were heated to 1050 C in one atmosphere of slowly flowing oxygen, saturated with water at 21 C, and containing about 50 ppm NaCl(g). Volatile products were detected for all materials except B-1900 and Ti. High pressure mass spectrometric sampling was used to directly identify volatile products emanating from samples of Cr and IN-738 subject to the above environments. Author

N77-20206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERCONDUCTIVITY IN SPUTTERED CuMo6S8
Samuel Alterovitz, John A. Woodllam, Lee Kammerdiner, Huey-Lin Luo, and Christopher Martin 1977 14 p refs Presented at the Conf. on High Polymer Phys., San Diego, Calif., 20-24 Mar. 1977; sponsored by the Am. Phys. Soc.
(NASA-TM-X-73620; E-9083) Avail: NTIS HC A02/MF A01 CSCL 11F

Samples were prepared by melting the metals, followed by annealing to various temperatures. The result was a structurally weak material. Sputtered films on sapphire substrates were prepared and studied. The substrates give the films mechanical strength and permit easy attachment of electrical leads. Materials were characterized by X-ray diffraction, electron microscopy, electrical resistance vs. temperature, and critical current measurements. Some of the results on CuMo6S8 are presented. Author

N77-20207*# Lockheed-California Co., Burbank.
FRACTURE CONTROL OF H-O ENGINE COMPONENTS Final Report, 17 Jun. 1974 - 5 Aug. 1976
J. T. Ryder Feb. 1977 489 p refs Prepared in cooperation with General Dynamics/Convair, San Diego, Calif., International Harvester, Chicago; and the Ladish Co., Cudahy, Wis.
(Contract NAS3-18896)
(NASA-CR-135137; LR-27810) Avail: NTIS HC A21/MF A01 CSCL 11F

An investigation was made to obtain the material characterization and fatigue crack propagation data necessary to establish the salient characteristics of a Ti-6Al-2.5Sn(ELI) alloy fuel pump impeller to be used in a cryogenic service environment. Testing variables considered were: coupon orientation, frequency, load range ratio, and temperature. Data analysis correlated crack propagation data from conventional laboratory coupons with data from a parallel sided rotating disk used to model rotor stresses. Four major design recommendations when bore regions of fuel pump impellers to be operated in cryogenic environments are to be relatively highly stressed are discussed. Author

N77-20208*# Cyclops Corp., Bridgeville, Pa. Specialty Steel Div.
DEVELOPMENT OF AN EXTRA-HIGH STRENGTH POWDER METALLURGY NICKEL-BASE SUPERALLOY Final Report
W. B. Kent Jan. 1977 67 p refs
(Contract NAS3-16795)
(NASA-CR-135131; U-C-R-1173) Avail: NTIS HC A04/MF A01 CSCL 11F

A program was conducted to optimize the composition of NASA IIb-11, an alloy originally developed as a wrought material, for thermal stability and to determine the feasibility for producing the alloy using powder metallurgy techniques. Seven compositions were melted and atomized, hot isostatically pressed, cross rolled to disks and heat treated. Tensile and stress rupture properties from room temperature to 870 C (1600 F) were determined in addition to thermal stability characteristics. Processing variables included hot isostatic pressing parameters and handling, cross rolling procedures and heat treatment cycles. NASA IIb-11E displayed the best combination of overall properties for service as a 760 C (1400 F) disk material. Its composition is 0.06 C, 8.5 Cr, 9.0 Co, 2.0 Mo, 7.1 W, 6.6 Ta, 4.5 Al, 0.75 Ti, 0.5 V, 0.7 Hf, 0.01 B, 0.05 Zr and balance Ni. While the alloy exhibits the highest 760 C (1400 F) rupture strength reported for any powder metallurgy disk alloy to date, additional studies to further evaluate the effects of heat treatment may be required. The alloy is not susceptible to topologically close-packed phase formation during thermal exposure at 870 C (1600 F) for 1,500 hours, but its mechanical property levels are lowered due to grain boundary carbide formation. Author

N77-20209# National Materials Advisory Board, Washington, D.C.
ELECTROSLAG REMELTING AND PLASMA ARC MELTING Technical Report, 15 May 1974 - Jun. 1975
1976 217 p refs
(Contract MDA903-74-C-0167)
(NMAB-324; LC-76-13351; ISBN-0-309-02505-2) Avail: NTIS HC A10/MF A01

An assessment is made of the electroslag remelting (ESR) and plasma arc melting (PAM) technologies used in the United States in manufacturing a variety of materials and sizes of ingots. Significant metal quality improvements in surface condition, mechanical properties, solidification, structure cleanliness, and yield over air-melted material have accelerated ESR usage, particularly abroad. PAM has potential in recycling scrap, producing complex alloys, large monocrystals of refractory metals and their alloys, and independent control of heat input and metal feed. ESR has found significant applications in producing premium quality high alloy and specialty alloy steels, providing features such as desulfurization, retention of volatile alloying elements, and the capability to produce shaped ingots and castings.Author

N77-20210# California Univ., Berkeley. Lawrence Berkeley Lab.
MARTENSITE TRANSFORMATION AND SHAPE MEMORY EFFECT IN Ni-Ti ALLOY Ph.D. Thesis
H. A. E. F. Mohamed May 1976 118 p refs
(Contract W-7405-eng-48)
(LBL-5112) Avail: NTIS HC A06/MF A01

A polycrystalline Ti-50.3 at. percent Ni alloy was investigated. It was found that the high temperature phase possesses a CsCl-structure (B2 type). During quenching from high temperature, excess Ni precipitates in the form of very fine highly coherent ordered particles or clusters prior to the martensitic transformation. The CsCl-structure transforms by inhomogeneous (110) [110] shear in a thermoelastic manner into a two-layer close-packed structure which has a distorted orthorhombic unit cell (martensite). The martensitic phase forms mostly in self-accommodating groups. Each member of a group is internally twinned and members of a group are themselves twin-related along the same plane. Deformation within the recoverable strain of a partially transformed material occurs by modes related to the transformation process itself. The memory effect can be explained in terms of the high reversibility of the transformation and this limitation of the deformation modes. ERA

N77-20211# Westinghouse Electric Corp., Madison, Pa Advanced Reactors Div.
SELF-WELDING EVALUATION OF TYPE 304 AND A286 STAINLESS STEEL IN THE TEMPERATURE RANGE 800 F - 1140 F IN FLOWING SODIUM

J. Y. Chang, P. N. Flagella, and S. L. Schrock 1976 23 p refs Presented at 9th Ann. Intern. Metallographic Soc. Meeting, Seattle, 25 Jul. 1976
(Contract E(11-1)-3045)
(CONF-760731-3) Avail: NTIS HC A02/MF A01

Two material combinations, Type 304 SS vs Type 304 SS and Type 304 SS vs A286, were tested at temperatures from 800 to 1140 F for time periods up to six months in flowing sodium. Contact stresses ranged from 2 to 30 ksi on contact areas for 0.63 to 1.00 sq inch. Tests were performed in either tensile or shear modes on the flat-on-flat samples. Surface morphologies of the sample before and after the test were presented. Self-welding of Type 304 SS was significant at temperatures above 1080 F while no self-welding was detected at 800 F. Sliding friction coefficient data for a Type 304 SS couple at 800 F under compressive stresses from 2,000 to 30,000 psi in sodium could be correlated quite accurately. One self-weld couple of Type 304 SS/Type 304 SS exposed at 1080 F for 3 months was not separated but rather removed intact from the test apparatus and examined in cross-section. Scanning electron micrographs of the contacted area revealed that portions of the original interface were no longer discernible. Author (ERA)

N77-20212# Cornell Univ., Ithaca, N.Y. Materials Science Center.
GAS PHASE HYDROGEN PERMEATION THROUGH FERRITIC IRON, AUSTENITIC STAINLESS STEEL FROM NEAR 300 K TO 873 K Ph.D. Thesis
N. R. Quick Jan. 1976 179 p refs
(Contract AT(11-1)-3166)
(COO-3166-18) Avail: NTIS HC A09/MF A01

Hydrogen permeation through iron was studied over the temperature range 300 to 873 K by an ultra high vacuum, monopole gas analyzer technique. Hydrogen gas input pressures were varied from 0.0043 to 0.62 atm and membrane thicknesses from 0.0165 to 0.243 cm. Volume diffusion control of the permeation process was demonstrated by the pressure and membrane thickness dependence of the steady state flux. The permeation coefficient, with an activation enthalpy of 8.1 + or - .4 kcal/mole, was independent of both gas pressure and membrane thickness. At temperatures below approximately 600 K, the effective diffusivity increased with both increasing hydrogen gas pressure and increasing membrane thickness. The transition temperature from classical to anomalous behavior decreased with increasing thickness. Apparent activation enthalphies for diffusion were thicker membranes. Diffusivity and permeation in neutron irradiated samples were both reduced in value. ERA

N77-20213# Purdue Univ., Lafayette, Ind. School of Materials Engineering.
TRANSPORT AND THERMODYNAMIC PROPERTIES OF SOLIDS Progress Report, 1 Sep. 1975 - 31 Aug. 1976
R. E. Grace and M. A. Dayananda 1976 15 p refs
(Contract E(11-1)-1436)
(COO-1436-47) Avail: NTIS HC A02/MF A01

The principal area of research is ternary diffusion in solid solution alloys. Specific research projects deal with diffusion in the Cu-Ni-Zn and Fe-Ni-Al systems (two projects). This report is a general summary of each of the projects either recently completed or in progress. ERA

N77-20214# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
MULTIAXIAL CREEP BEHAVIOR OF TYPE 304SS TUBULAR SPECIMENS
P. C. S. Wu, C. Daniels, and K. C. Thomas 1976 6 p refs Presented at 2d Intern. Conf. on the Mechanical Behavior of Materials, Federation of Materials Soc., Boston, 16 Aug. 1976
(Contract E(11-1)-3045)
(CONF-760819-7) Avail: NTIS HC A02/MF A01

Creep measurements were made on type 304 SS tublar specimens at 1100 F. Various constant load multiaxial stress and strain states were introduced by a combination of pressurization and axial loading. The measurements were processed to determine the average values for temperature, pressure, and effective stress and for axial, radial, circumferential, and effective strains. Based upon these data, a creep model was evaluated, and parameters were derived for the multiaxial constant load creep tests (10 to 20 ksi) at 1100 F as a function of stress. Microstructural characterization, including hardness measurements, grain size distribution, and cracking characteristics of the post-test specimens was made and correlated with the effective stress. ERA

N77-20215# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
ANALYSIS OF THE DUCTILE-BRITTLE TRANSITION TEMPERATURE IN Fe-BINARY ALLOYS
W. W. Gerberich and Y. T. Chen Apr. 1976 85 p refs Sponsored by ERDA
(TID-27054) Avail: NTIS HC A05/MF A01

Two significant developments in the study of flow and fracture pertain to the strain-rate sensitivity of bcc alloys: (1) solute softening: Peierls stresses in Fe and its alloys are found to decrease with either Ni or Si additions. However, the double knink nucleation energy is found to have a minimum near 2.5 at. percent alloy addition for both Ni and Si additions. It is found that solid solution softening in both alloy systems may be interpreted in terms of the Dorn-Rajnak double kink model. (2) ductile-brittle transition: A DBTT model was derived with the double kink formation energy, Peierls stress, cleavage fracture stress, plastic constraint, and strain rate as the controlling parameters. The significance is that alloy effects on both solid-solution softening and the cleavage fracture stress were incorporated into a single criterion. ERA

N77-20216# Sandia Labs., Albuquerque, N.Mex.
GRAIN BOUNDARY PRECIPITATION IN A NICKEL-BERYLLIUM ALLOY
T. V. Nordstrom 1976 20 p refs Presented at 9th Ann. Intern. Metallographic Soc. Meeting, Seattle, 25 Jul. 1976
(Contract AT(29-1)-789)
(SAND-76-5327; Conf-760731-1) Avail: NTIS HC A02/MF A01

The morphology and kinetics of discontinuous grain boundary precipitation were studied in a nickel 1.89 wt. percent (11.1 at. percent) beryllium alloy. The cells were found to have an irregular lamellar structure with a continuous nickel rich phase and NiBe platelets. There is no consistent habit plane observed but at least three orientation relationships do exist between the two phases. The most frequently observed relation was[100] sub NiBe/ parallel parallel [001] sub Ni/ : (001)/sub NiBe /parallel parallel (110)/sub Ni/. The kinetics of the reaction were found to follow a linear growth with time. The activitation energy of approximately 55 cal/mole is less than bulk self diffusion of nickel but greater than grain boundary self diffusion. ERA

N77-20217# Oak Ridge National Lab., Tenn.
MAGNETIC MOMENT DISTRIBUTION OF FERROMAGNETIC Ni-Rh ALLOYS
J. W. Cable and E. O. Wollan Aug. 1976 9 p refs Presented at Intern. Conf. on Magnetism, Amsterdam, 6 Sep. 1976
(Contract W-7405-eng-26)
(CONF-760922-5) Avail: NTIS HC A02/MF A01

The diffuse scattering of polarized and unpolarized neutrons was used to determine the spatial distribution of the magnetic moment for ferromagnetic Ni-Rh alloys. The average Ni moment remains near 0.6 microns/sub B/ to 12 at. percent Rh and then decreases toward zero at the critical concentration of 37 at. percent Rh. There is an initial rapid decrease in the Rh moment that follows a P12 dependence and corresponds to a moment of 2 microns/sub B/ for isolated Rh atoms. The data indicate moment fluctuations at both the Ni and the Rh sites that are associated with local environment. ERA

N77-20218# Hanford Engineering Development Lab., Richland, Wash.
EFFECT OF TEMPERATURE UPON THE FATIGUE-CRACK PROPAGATION BEHAVIOR OF INCONEL X-750
L. A. James May 1976 22 p refs
(Contract E(45-1)-2170)
(HEDL-TME-76-39) Avail: NTIS HC A02/MF A01

The techniques of linear elastic fracture mechanics were employed to characterize the effect of temperature upon the

fatigue crack propagation behavior of precipitation heat treated Inconel X-750 in an air environment over the range 75-1200 F. In general, fatigue crack growth rates increased with increasing test temperature. ERA

N77-20219# Hanford Engineering Development Lab., Richland, Wash.
EFFECT OF TEMPERATURE UPON THE FATIGUE-CRACK PROPAGATION BEHAVIOR OF HASTELLOY X-280
L. A. James May 1976 18 p refs
(Contract E(45-1)-2170)
(HEDL-TME-76-40) Avail: NTIS HC A02/MF A01

The techniques of linear elastic fracture mechanics were employed to characterize the effect of temperature upon the fatigue crack propagation behavior of Hastelloy X-280 in an air environment. Also included are survey tests to determine the effects of thermal aging and stress ratio upon crack growth behavior in this alloy. ERA

N77-20220# Brown Univ., Providence, R. I. Div. of Engineering.
OBSERVATIONS ON THE EFFECT OF CEMENTITE PARTICLES ON THE FRACTURE TOUGHNESS OF SPHEROIDIZED CARBON STEELS
S. P. Rawal and J. Gurland Feb. 1976 37 p refs Presented at the 2d Intern. Conf. on Mech. Behavior of Mater., Federation of Mater. Soc., Boston, 16-20 Aug. 1976
(Contract E(11-1)-3084)
(COO-3084-41; Conf-760819-8) Avail: NTIS HC A03/MF A01

The results of experimental studies of the influence of cementite particles on the fracture toughness of a number of spheroidized carbon steels at low temperatures were analyzed in terms of current theories of crack-tip behavior. The fracture toughness parameter K/sub IC/ was evaluated under plane-strain conditions by using circumferentially notched and fatigue cracked cylindrical specimens. The conclusions are presented. ERA

N77-20221# General Atomic Co., San Diego, Calif.
GAS-TURBINE HTGR MATERIALS SCREENING TEST PROGRAM INTERIM RESULTS
S. N. Rosenwasser and W. R. Johnson 30 Jun. 1976 240 p refs
(Contract E(04-3)-167)
(GA-A-13931) Avail: NTIS HC A11/MF A01

The Gas-Turbine High-Temperature Gas-Cooled Reactor (GT-HTGR) Materials Screening Test Program was performed to identify and evaluate structural alloys for application in the system's power conversion loop components. Six vacuum-cast nickel-base alloys, IN100, Rene 100, IN713, MM004, M21, and IN738, and two wrought nickel-base alloys, Hastelloy X and Inconel 617, were creep tested and aged unstressed in simulated GT-HTGR controlled-impurity helium at 650, 800, and 900 C. Specimens were removed at 3,000 hr for detailed metallurgical evaluation, while duplicate specimens achieved 6,000 hr test durations. A limited number of tensile and impact specimens were aged unstressed at 800 C for 3,000 hr. Room-temperature tensile and instrumented impact tests were conducted on as-received and 3,000-hr exposed specimens. Detailed metallurgical evaluations were conducted to study helium impurity/metal interactions and thermal aging effects. ERA

N77-20222# Oak Ridge National Lab., Tenn.
EFFECT OF FATIGUE CRACKING DAMAGE ON THE SOLID VISCOSITY OF STEEL RODS
[1976] 3 p Transl. into ENGLISH from Bundesanstalt fuer Mater. (Berlin)
(Contract W-7405-eng-26)
(ORNL-TR-4146) Avail: NTIS HC A02/MF A01

The use of damping measurements for early detection of fatigue cracking in steel rods was investigated. It was found that a prior mechanical stress leads to a higher damping at greater measured amplitudes. The range of amplitude-dependent damping sets in at strains which are smaller as the number of preceding load cycles is greater. ERA

N77-20223# Oak Ridge Y-12 Plant, Tenn.
VARIABLES THAT AFFECT MECHANICAL PROPERTIES OF URANIUM-0.75 TITANIUM ALLOYS
J. W. Koger and V. C. Hemperly 12 May 1976 12 p refs Presented at Conf. on High Density Alloy Penetrator Materials, Charlottesville, Va., 24 May 1976
(Contract W-7405-eng-26)
(Y-DA-6665; Conf-760540-10) Avail: NTIS HC A02/MF A01

Mechanical properties of the U-0.75 Ti alloy are affected by variables of aging temperature, aging time, melt temperature, melt time, double melting, working temperature, homogenization time and temperature, test atmosphere, humidity, plating, machining method, and the chemical levels of titanium, silicon, and iron in the alloy. ERA

N77-20224# Oak Ridge Y-12 Plant, Tenn.
DEVELOPMENT OF DUCTILE TUNGSTEN ALLOYS
J. M. Googin, W. L. Harper, A. C. Neeley, and L. R. Phillips 3 Aug. 1961 76 p refs
(Contract W-7405-eng-26)
(Y-1364) Avail: NTIS HC A05/MF A01

The fabrication of ductile tungsten alloys was investigated and their mechanical properties measured. Tungsten-nickel-iron alloys with tungsten contents of 93 percent or higher were studied most extensively. The influences of various processing parameters upon ductility are reported. Of those alloys which attained a density of approximately 18.00 g/cubic cm, the 95 percent W-3.5 percent Ni-1.5 percent Fe was found to be the most ductile, elongating 17.6 percent on the average and as much as 28 percent, and having average ultimate and yield strengths of 136,900 and 92,500 psi, respectively. ERA

N77-20225# Oak Ridge Y-12 Plant, Tenn.
ULTRASONIC AND IMPACT TECHNIQUES USED TO CHARACTERIZE LIQUID-PHASE-SINTERED TUNGSTEN ALLOYS
M. W. Moyer and R. E. Oakes, Jr. 1976 14 p refs Presented at conf. on High Density Alloy Penetrator Materials, Charlottesville, Va., 24 May 1976
(Contract W-7405-eng-26)
(Y-DA-6661; Conf-760540-β) Avail: NTIS HC A02/MF A01

The majority of the effort was centered on two materials--a 90 W-7 Ni-3 Fe alloy with 25 percent cold work and 95 W-3.5 Ni-1.5 Fe alloy with 18 percent cold work. Fracture toughness concerts, along with instrumented Charpy impact tests were used to measure toughness differences and temperature effects on toughness for several alloys. The instrumented Charpy was useful in screening alloys having different processing parameters. Spectral analysis shows high attentuation of all frequencies in areas of matrix depletion and very low attenuation of energy between 10 and 15 MHz for conditions of incomplete sintering when compared to normal material. Efforts are underway to develop a higher density alloy. Of major concern in the higher tungsten alloys is cracking which may occur during swaging. Preliminary ultrasonic techniques to detect cracks are discussed. ERA

N77-20226# Sandia Labs., Livermore, Calif. Metallurgy and Electroplating Div.
HIGH STRAIN RATE MECHANICAL RESPONSE OF BUTTRESS-GROOVED TENSILE SPECIMENS WHICH HAVE UNDERGONE ENVIRONMENTAL EXPOSURE
L. J. Weirick Jul. 1976 45 p refs Presented at the Conf. on High Density Alloy Penetrator Materials, Charlottesville, Va., 24-27 May 1976
(Contract E(29-1)-789)
(SAND-76-8634; Conf-760540-15) Avail: NTIS HC A03/MF A01

The effect of corrosion on the mechanical performance of the buttress grooved section of the 105 mm penetrator was investigated. Both coated and uncoated test specimens which simulate both geometrical shape and residual stress patterns were exposed to corrosive environments of moist air, distilled water, and salt water. Some of these tests also incorporated the galvanic coupling caused by the aluminum sabot. After exposure to the corrosive environments, the specimens were pulled on a high strain rate tensile machine which simulated launch conditions. Results show that the galvanic coupling due to the aluminum sabot caused no deterioration of mechanical properties. Results do indicate that the coating applied caused

a significant reduction in the fracture load. Uncoated test specimens showed no change in fracture load with increasing severity of corrosion environment, whereas the coated specimens indicated a trend of decreasing load-bearing ability with increasing corrosion. ERA

N77-20227# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.

EQUILIBRIUM STRUCTURES OF TYPE 304 AND TYPE 316 STAINLESS STEEL IN THE TEMPERATURE RANGE 800 DEGREES F TO 1500 DEGREES F: A METALLOGRAPHIC REVIEW

C. Bagnall and S. A. Shiels 1976 15 p refs Presented at the 9th Ann. Intern. Metallographic Soc. Meeting, Seattle, 25-28 Jul. 1976

(Contract E(11-1)-3045)

(CONF-760731-2) Avail: NTIS HC A02/MF A01

The phase diagrams serve as a general guide to the structures that may be found in Type 304 and Type 316 stainless steels as thermodynamic equilibrium is approached. A large change in grain size from those shown (ASTM 8-9), also have an effect on the distribution of the second phases. The proposed mechanism for sigma formation in Type 304 SS require substantiation with additional experimental evidence over the 1100-1500 F temperature range using material containing carbon up to the H-grade level of 1000 ppM. ERA

N77-20228# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

EFFECT OF HYDROGEN ON THE FRACTURE TOUGHNESS OF 17-4 PH STAINLESS STEEL

T. L. Capeletti 1976 13 p refs Presented at 2d Intern. Conf. on the Mech. Behavior of Mater., Boston, 16 Aug. 1976; sponsored by Federation of Mater. Soc. Submitted for publication

(Contract E(07-2)-1)

(DP-MS-75-88; Conf-760819-12) Avail: NTIS HC A02/MF A01

Fracture toughness of 17-4 PH stainless steel decreased significantly with increased hydrogen test pressure for a variety of heat treatment conditions: solution annealed, underaged, peak-aged, and overaged. Minimum toughness was obtained with peak-aged samples tested in 69.5-MPa hydrogen; toughness was maximum for samples tested in helium. ERA

N77-20229# California Univ., Berkeley. Lawrence Berkeley Lab.

TRANSPORT ASPECTS OF ELECTROCHEMICAL MACHINING AND ELECTROMETALLURGY

Rolf H. Muller May 1976 35 p refs Presented at Meeting of the Am. Inst. of Chem. Engr., Atlantic City, N. J., 27 Aug. 1976

(Contract W-7405-eng-48)

(LBL-5128; Conf-760823-7) Avail: NTIS HC A03/MF A01

Geometrical shape and surface finish resulting from deposition or dissolution reactions are determined by the current distribution on a macroscopic and microscopic scale. Macroscopic current distributions were determined experimentally by different electrical and optical means and are compared to theoretical expectations based on transport correlations and numerical models. ERA

N77-20230# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

STRUCTURE AND MECHANICAL PROPERTIES OF Fe-Cr-Mo-C ALLOYS WITH AND WITHOUT BORON

Yen-Lung Chen May 1976 123 p refs Sponsored in part by the Ministry of Education, Republic of China

(Contract W-7405-eng-48)

(LBL-5423) Avail: NTIS HC A06/MF A01

Nonconventional heat treatments were designed to improve the mechanical properties of these martensitic steels. Results show that the as-quenched structures of both steels consist mainly of dislocated martensite. In the boron-free steel, there are more lath boundary retained austenite films. The boron-treated steel shows higher strengths at all tempering temperatures but with lower Charpy V-notch impact energies. Both steels show tempered martensite embrittlement when tempered at 350 C for 1 hour. The boron-free steel shows a continuous increase in toughness when tempered above 500 C; the boron-treated steel suffers a second drop in toughness at 600 C tempering. Boron seems to impair room temperature impact toughness at low strength levels but not at high strength levels. By simple nonconventional heat treatments, martensitic steels may be produced with superior strength-toughness properties. ERA

N77-20231# California Univ., Berkeley. Lawrence Berkeley Lab.

LATTICE IMAGE AND OPTICAL DIFFRACTION STUDIES OF ALLOYS

G. Thomas, R. Sinclair, and R. Gronsky Mar. 1976 8 p refs Presented at 6th European Congr. on Electron Microscopy, Jerusalem, 14 Sep. 1976

(Contract W-7405-eng-48)

(LBL-4962; Conf-760928-2) Avail: NTIS HC A02/MF A01

Progress in applying lattice imaging to problems in alloys at the atomic level is reviewed. This was illustrated by results on unit cell high steps in interfaces in ordered Mg3Cd, on direct and reciprocal space studies of spinodal decomposition in Au-Ni and on grain boundary precipitation in Al-Zn. Direct images were complemented by optical diffraction patterns, with the possibility of using selecting apertures down to 10A in diameter, which is a considerable reduction over conventional electron diffraction. Such apertures were also smaller than areas currently selected by the beam size in scanning transmission electron microscopy. The microdiffraction capability was used to solve ambiguous, conventional diffraction patterns, such as those obtained from short-range ordered alloys, and for more complex patterns, as for instance obtained from ordered stacking structures in SiC. ERA

N77-20232# Bendix Corp., Kansas City, Mo.

SMALL POWDER PARTS

E. P. Patterson Aug. 1976 29 p

(Contract E(29-1)-613)

(BDX-613-1386-Rev) Avail: NTIS HC A03/MF A01

Infrequently used techniques for assembling simple powder shapes into complex arrangements were successfully employed in the fabrication of small sintered metal parts for use in miniature electromechanical devices. These parts are produced from plain high- and low-carbon steels, stainless steels, and various other alloys of steel, copper, nickel, and aluminum, as well as refractory metals. Unit costs are only a fraction of those for comparable machined parts. ERA

N77-20233# Oak Ridge Y-12 Plant, Tenn. Dept. of Physical Testing.

PRODUCTION METHOD FOR THE VACUUM IMPREGNATION OF A LARGE NUMBER OF METALLOGRAPHIC SPECIMENS

P. B. Petretzky 1976 9 p Presented at the 9th Annual International Metallographic Convention, Seattle, 25-28 Jul. 1976

(Contract W-7405-eng-26)

(Y/DL-521; Conf-760631-4) Avail: NTIS HC A02/MF A01

A production method was developed for the rapid vacuum impregnation of a large number of metallographic specimens. This impregnation method is accomplished by feeding epoxy to a number of specimens positioned on a rotary stage which is located in a vacuum chamber. The method is fast and simple, and can be utilized for impregnating various types of materials. ERA

N77-20234# Sandia Labs., Albuquerque, N.Mex.

ELECTRON MICROPROBE STUDIES OF METAL-CERAMIC BRAZE JOINTS

W. F. Chambers and P. F. Hlava 1976 5 p refs Presented at 34th Electron Microscopy Soc. of Am. Ann. Meeting, Miami Beach, Fla., 9 Aug. 1976

(Contract AT(29-1)-789)

(SAND-76-5318; Conf-760803-11) Avail: NTIS HC A02/MF A01

Methods of conducting stress analyses in metal-ceramic braze joints involving Kovar and alumina compositions are described. A schematic illustration of a braze configuration is included. The composition range for the glassy phase of the alumina system is tabulated. Through mixture theory, using measured and

tabulated properties plus relative amounts of each phase, mechanical and physical properties of the metallized region of the alumina ceramic were determined. ERA

N77-20235# Addis Translations International, Portola Valley, Calif.
NICKEL-IRON AND NICKEL-SILICON ALLOYS WHICH DO NOT SWELL UNDER FAST-NEUTRON IRRADIATION
G. Silvestre, A. Silvent, C. Regnard, and G. Sainfort 1975 30 p refs Transl. into ENGLISH from J. Nucl. Mater. (France), v. 57, 1975 p 125-135 Prepared for Battelle Pacific Northwest Labs., Richland, Wash.
(Contract E(45-1)-1830)
(BNWL-TR-188) Avail: NTIS HC A03/MF A01

The effect of fast neutron irradiation on the swelling of nickel and nickel alloys is discussed. The materials studied were Ni-Fe and Ni-Si. At low concentrations the added elements are in dissolved form and reduce swelling, silicon being very efficient. At higher concentrations, irradiation of Ni-Fe and Ni-Si alloys causes formation of plate shaped precipitates of the Ni3X type, and these alloys do not swell. ERA

N77-20236# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
A LITERATURE SURVEY ON THE FATIGUE PROPERTIES OF SIMILAR CAST AND WROUGHT MATERIALS. PART 1: STEELS
H. VanDerLaan 15 Jun. 1976 20 p refs
(FOK-S-142-Pt-1) Avail: NTIS HC A02/MF A01

From four references, information concerning fatigue and crack propagation is gathered and discussed. Fatigue properties of smooth specimens seem to be lower for castings, but if stress concentrations are present no discrepancies between cast and wrought material are observed. Crack propagation rates in cast material appear to be equal to or lower than those in wrought material. Author (ESA)

N77-20237# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
FATIGUE TESTS ON TWO SIDES CLAD - ONE SIDE MACHINED AND ONE SIDE CHEMILLED 2024-T3 - AND 7075-T6 CLAD SHEET (AvB 1435)
H. VanDerLaan 12 Dec. 1975 35 p refs
(FOK-SP-80) Avail: NTIS HC A03/MF A01

Due to the forced replacement of roll tapered sheets by either machine tapered or chemill tapered sheets in wing and stabilizer structures of the F27, F28, and VFW-614, comparative fatigue tests were carried out on anodized two sides clad sheet, one side machined clad sheet, and one side chemilled clad sheet in alloys 2024-T3 and 7075-T6; S-N curves were derived for k sub t = 1.4 and 2.87 and for rivet joints at R-values reaching from approx. 0.1 to 0.3 (Pmin = 400 kg) and crack propagation rates were measured. For both 2924-T3 and 7075-T6, no significant differences were found between the three production methods, either in fatigue strength or in crack propagation rates. Author (ESA)

N77-20238# Army Electronics Command, Fort Monmouth, N.J.
DESIGN OF A NOZZLE BEAM TYPE METAL VAPOR SOURCE
Ronald P. Andres (Princeton Univ.) Oct. 1976 22 p refs
(AD-A031646; ECOM-4437) Avail: NTIS HC A02/MF A01 CSCL 13/8

A prototype design of a directional high flux source for use in vapor deposition of electrode materials during fabrication of precision quartz crystal resonators is presented. The design is based on the theory and technology of nozzle beams. This nozzle beam type source is conceived: (1) to permit large deposition rates with minimum waste of electrode materials, (2) to operate in the high vacuum, (3) to emit vapor in a horizontal direction, thereby permitting the use of a pair of sources to plate both sides of a substrate simultaneously, and (4) to operate for extended periods without requiring frequent breaking of the vacuum in order to replenish the source. It is estimated that this design can operate at a deposition rate equal or above that of a conventional evaporation type source with less than one percent of the waste of electrode material experienced with a conventional source. Author (GRA)

N77-20239# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
INHIBITION OF CRACK PROPAGATION OF HIGH STRENGTH STEELS THROUGH SINGLE AND MULTIFUNCTIONAL INHIBITORS Final Report, Jan. 1974 - Nov. 1975
Charles T. Lynch, Kirit J. Bhansali, and Phillip A. Parrish Aug. 1976 37 p refs
(AF Proj. 7351)
(AD-A030875; AFML-TR-76-120) Avail: NTIS HC A03/MF A01 CSCL 11/6

Oxidizing inhibitors may be used to retard crack propagation for high strength low alloy steels. For D6AC the use of such inhibitors gives promise of being able to avoid hydrogen embrittlement. The critical stress intensity factor Klscc apparently may also be manipulated by use of oxidizing inhibitors. Preliminary data on multifunctional inhibitors indicate that combinations of cathodic and anodic types is more effective than the common anodic inhibitors such as chromate Hydrazine and the related nitrite ion are more effective inhibitors than chromate for steel in the presence of chlorides. Author (GRA)

N77-20240# Aluminum Co. of America, Alcoa Center, Pa. Technical Center.
METALLURGICAL FACTORS CONTROLLING STRUCTURE IN HIGH STRENGTH P/M PRODUCTS Final Technical Report, Apr. 1974 - Oct. 1975
W. L. Otto, Jr. Wright-Patterson AFB, Ohio AFML May 1976 114 p refs
(Contract F33615-74-C-5077; AF Proj. 7351)
(AD-A030606; AFML-TR-76-60) Avail: NTIS HC A06/MF A01 CSCL 11/6

The effects of process variables upon the structure/property relationships for Al-Zn-Mg-Cu-Co powder metallurgy alloys were investigated. Variations in alloy composition, atomized powder characteristics, hot compacting procedures, hot work operations, and heat treatments were evaluated by tensile, stress corrosion, toughness, and fatigue crack growth rate testing, as well as micro-structural examination. Optimum process steps were identified, resulting in P/M products with properties superior to those of commercial 7000 series ingot alloys. In particular, the P/M MA87 alloy (6.5Zn-2.5Mg-1.5Cu-0.4Co) was found to have increased strength, equal ductility, and substantially higher toughness than 7050 alloy forging of equal stress corrosion resistance. Of special significance was the improved resistance to fatigue crack growth rate of this alloy. P/M MA87 alloy forging fabricated from triple upset and drawn billet demonstrated fatigue crack growth rates 15 to 1000% slower than 7050 alloy forgings. Author (GRA)

N77-20241# Battelle Columbus Labs., Ohio.
GRAIN ASPECT RATIO STRENGTHENING OF DISPERSION HARDENED METALS Final Report, 1 May 1971 - 30 Apr. 1976
A. H. Clauer and B. A. Wilcox 1976 14 p refs
(Grant AF-AFOSR-2083-71)
(AD-A031018; AFOSR-76-1086TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The effect of a prestrain dislocation substructure on the tensile creep of MgO single crystal specimens compared with annealed specimens was investigated. Specimens having a substructure consisting of subgrains were slightly stronger than those having a uniform dislocation distribution but the strongest condition were annealed specimens having few dislocations. Without strong pinning, the prestrain dislocation substructure merely provided a higher density of mobile dislocations. Substructural strengthening of an oxide dispersion hardened metal, TD-NiCr showed that a dislocation substructure added only a modest amount to the creep strength and the effect appeared to be sensitive to the level of prestrain used. The temperature and strain rate dependence of the grain aspect ratio effect on TD-Ni was investigated at 871 and 600 C over a range of strain rate. The strengthening effect of elongated grains persisted down to 600 C although strengthening due to grain refinement also contributed at 600 C. The strength increased with increasing grain aspect ratio (G.A.R.) linearly up to a ratio of 10 to 15, after which the strength increased only slowly with further increase in G.A.R. This limit of G.A.R. = 10 to 15 was independent of temperature and strain rate. An expression combining grain boundary sliding and

deformation of the grains duplicated the form of the G.A.R. effect on creep strength. Author (GRA)

N77-20242# Battelle Columbus Labs., Ohio.
INITIAL DEVELOPMENT OF A FATIGUE-CRACK-RETARDATION MODEL Final Report, 18 Jun. 1974 - 31 Dec. 1975
M. F. Kanninen, C. E. Feddersen, and C. Atkinson 31 Jan. 1976 123 p refs
(Contract N62269-74-C-0618)
(AD-A031071; BATT-G-2920; NADC-76076-30) Avail: NTIS HC A06/MF A01 CSCL 11/6

A fatigue-crack-propagation model is developed by reducing crack-tip plasticity to a single pair of enlarged dislocations, termed superdislocations, whose response is equivalent to that of the aggregate plastic zone. The crack-tip damage or deformation and accompanying incremental crack advance resulting from each loading cycle are accumulated in a single super-superdislocation pair for residual interaction on the next loading cycle. Key features of this development are that the required material parameters are limited to the shear modulus, Poisson's ratio, and tensile-yield strength, and that crack-surface closure is accommodated. A significant simulation of the fatigue-crack-propagation process along with a promising correlation with experimental results are achieved. Author (GRA)

N77-20243# Cincinnati Univ., Ohio.
COMPARISON OF PROCESSING PROPERTIES AND PRODUCT PROPERTIES OF BETA III TITANIUM ALLOY POWDER METAL (PM) AND INGOT METAL (IM) Final Report, Feb. 1975 - Feb. 1976
N. Birla, Vincent DePierre, and Attwell M. Adair Wright-Patterson AFB, Ohio AFML Jun. 1976 57 p
(Contract F33615-73-C-5097; AF Proj. 7351)
(AD-A030794; AFML-TR-76-89) Avail: NTIS HC A04/MF A01 CSCL 11/6

United States Air Force interest in powder metallurgy stems largely from the potential benefits obtainable by use of metal powders, instead of ingot materials, for the production of metal products. These benefits include reduction in production costs and improved service performance of aerospace parts. Metal powder processing may furnish lower production costs by reduction of the number of processing operations to convert raw materials to finished parts and by minimization of scrap losses and machining. Titanium alloys have very attractive service properties (such as high strength, toughness and corrosion resistance) for aerospace applications. However, the high unit costs for finished titanium alloy parts limit the full utilization of these materials because of economic considerations. GRA

N77-20244# Construction Engineering Research Lab. (Army), Champaign, Ill.
CHLORIDE SENSITIVITY OF THE CORROSION RATE OF ZINC-COATED REINFORCING BARS Interim Report
C. Hahin, S. Cato, and W. Mattheessen Sep. 1976 33 p refs
(DA Proj. 4A7-62719-AT-41)
(AD-A030565; CERL-IR-M-191) Avail: NTIS HC A03/MF A01 CSCL 11/6

This laboratory study was undertaken to determine whether zinc coatings can be relied on for long-term protection of reinforcing bars subject to environments of variable salt concentrations. Hot-dip galvanized reinforcing bars were coupled to bare carbon steel rebars in various concentrations of CaCl2 in saturated Ca(OH)2-distilled water solutions. Galvanic current output was monitored as a function of time and percent CaCl2 for a zinc-steel couple with an anode-cathode area ratio of unity. Current output became stable after 20 days for CaCl2 concentrations less than 1 percent. For concentrations at 1 percent or greater, current fluctuations were cyclical, increasing in magnitude as percent CaCl2 increased. At 4 percent CaCl2, current output rose sharply. Author (GRA)

N77-20245# Naval Research Lab., Washington, D.C.
EFFECTS OF FLOWING NATURAL SEAWATER AND ELECTROCHEMICAL POTENTIAL ON FATIGUE-CRACK GROWTH IN SEVERAL HIGH-STRENGTH MARINE ALLOYS Final Report
T. W. Crooker, F. D. Bogar, and W. R. Cares 30 Aug. 1976 15 p refs
(NRL Proj. M01-24; RR0220146)
(AD-A030903; NRL-8042) Avail: NTIS HC A02/MF A01 CSCL 11/6

Fatigue crack propagation was studied on samples of four high-strength marine alloys to determine the sensitivity of fatigue-crack growth rates to seawater and electrochemical potential. The materials studied included HY-130 steel, 17-4 PH steel in several combinations of melt processing and temper, Ti-6Al-2Cb01Ta-0.8Mo, and 5456-H116 aluminum. Fatigue testing was conducted at low cyclic frequency, and the fatigue data are presented in terms of fatigue-crack growth rate (da/dN) versus crack-tip stress-intensity factor range (Delta K). Test specimens were exposed to fresh flowing natural seawater under freely corroding and potentiostat-controlled electrochemical conditions while undergoing corrosion-fatigue-testing. The results of this investigation reveal significantly distinct differences among the four alloys under the conditions of corrosion fatigue. Both seawater and potential acted to accelerate crack growth rates in the ferrous alloys, which proved to be much more sensitive to seawater and negative potential than the nonferrous alloys studied. The titanium alloy exhibited no measurable sensitivity to either seawater or negative potential. The aluminum alloy exhibited only moderate sensitivity to seawater and beneficial effects from both positive and negative potentials. These exploratory studies indicate that high-strength marine alloys exhibit widely differing responses to corrosion-fatigue crack growth and that high-strength steels currently aimed for marine service are among the alloys most deleteriously affected. GRA

N77-20246# Office of Naval Research, London (England).
THE ISRAELI-AMERICAN INTERNATIONAL CONFERENCE ON APPLIED METALLURGY
Herbert Herman 30 Aug. 1976 13 p Proc. held at Tel Aviv, Israel, 4-8 Apr. 1976
(AD-A030908; ONRL-C-25-76) Avail: NTIS HC A02/MF A01 CSCL 11/6

This joint ASM-IMS meeting on applied metallurgy was attended by a good representation of academia and industrial scientists and engineers. A wide range of topics was covered from non-destructive evaluation, joining, failure analysis, to electronic materials. The diversity and sophistication of interests shown by the Israeli indicated that theirs is a growing and forward-thinking industry, and that joint international conferences like this one are in fact mutually beneficial. Author (GRA)

N77-20247# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
EFFECTS OF SOLUTE REDISTRIBUTION ON THE STRUCTURE AND PROPERTIES OF CAST ALLOYS
J. Mathews, S. A. David, K. Y. Lin, and H. D. Brody Aug. 1976 35 p refs Presented at Conf. on Computer Simulation for Mater. Appl., Gaithersburg, Md., Apr. 1976
(Contract N00014-75-C-0800)
(AD-A030769; SETEC-MME-76-030) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report summarizes work on composite and alloy solidification presently conducted under the ONR contract and includes two papers on the simulation of heat flow and thermal stresses in continuous casting presented at the 'Conference on Computer Simulation for Materials Applications' in Gaithersburg, Md. in April 1976. A final element analysis of heat transfer in continuous casting is presented in the first paper. The steady state conditions of the solidification of a cylindrical alloy ingot are simulated. The analysis takes into account both radial and axial heat conduction and the variation of alloy properties with temperature. The analysis has the versatility to simulate any casting configuration as the program has the capability to treat any arbitrary boundary conditions. In the mold region, where an air gap generally forms, the position of gap formation, the size of the gap and the heat transfer through the gap by conduction and radiation are computed. Values predicted by the model are in close agreement with published laboratory and industrial data. GRA

N77-20248# Purdue Univ., Lafayette, Ind. Solid Mechanics and Materials Lab.
FATIGUE CRACK CLOSURE BEHAVIOR: A COMPARATIVE

STUDY Final Report, 15 Jun. 1975 - 14 Aug. 1976
J. E. Rueping and B. M. Hillberry Aug. 1976 106 p refs
(Grant AF-AFOSR-2852-75; AF Proj. 9782)
(AD-A031124; AFOSR-76-1090TR) Avail: NTIS HC A06/MF A01 CSCL 11/6

Fatigue crack closure behavior in 2024-T3 aluminum alloy was investigated using a laser interferometry method developed in this investigation and an 'Elber' type displacement gage. The crack closure results using the two measurement methods are compared for constant amplitude loading. The displacement gage was also used to measure the crack closure behavior following selected overload/underload sequences. These results are compared with an inverse technique. The measurement methods and equipment are described and the crack closure results are presented. Author (GRA)

N77-20249# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
A STUDY OF HIGH TEMPERATURE DEFORMATION IN DISPERSION STRENGTHENED METAL SINGLE CRYSTALS Final Report
William D. Nix, John H. Holbrook, Richard W. Lund, Paul S. Gilman, and George M. Pharr Oct. 1976 14 p refs
(Grant AF-AFOSR-2434-73)
(AD-A030886; AFOSR-76-1089TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The objective of the work of this research program was to obtain an understanding of the mechanisms that control high temperature deformation in metal single crystals containing non-deformable particles. This objective was motivated by the belief that the presence of grain boundaries invariably degrades the creep and rupture properties of commercial dispersion strengthened metals and confuses efforts to understand their properties. The authors believe this work has made it easier to understand the unusual properties of dispersion strengthened metals. The main thrust of experimental work has been on single crystals of Ni-20Cr-2ThO2. GRA

N77-20250# TRW, Inc., Cleveland, Ohio.
COATING PROCESSES FOR COLUMBIUM ALLOYS Final Report, 7 May 1974 - 7 Nov. 1975
M. T. Groves Sep. 1976 95 p refs
(Contract DAAG46-74-C-0097)
(AD-A031030; AMMRC-CTR-76-28; AVSCOM-76-39) Avail: NTIS HC A05/MF A01 CSCL 11/3

The purpose of the program was to develop improved processing techniques for depositing the NS-4 coating on columbium alloys. The NS-4 coating consists of depositing a vacuum sintered modifier layer (nominal composition 20Mo-50W-15Ti-15V) and then siliciding the modifier layer. The objectives of this program were to develop an electrophoretic process for depositing the modifier layer and a chemical vapor deposition process for siliciding the modifier layer. Electrophoretic deposition from both waterbase and isoproponol suspensions was investigated for deposition of the modifier layer. Satisfactory deposits could not be obtained from waterbase suspensions. Gases resulting from electrolysis of the water produced defects in these deposits. Satisfactory deposits were obtained from isoproponol-nitromethane suspensions. Parameters were developed for depositing nominal modifier layer thicknesses of 2.0, 3.5 and 5.0 mils from suspensions containing total Ti-V contents of 10 w/o, 20 w/o and 30 w/o. Deposition parameters were developed for depositing silicon on the modifier layer by hydrogen reduction of SiCl4. GRA

N77-20251# Naval Research Lab., Washington, D.C.
DIRECT LABORATORY FUNDED PROGRAM - RELIABILITY CRITERIA FOR ADVANCED STRUCTURAL MATERIALS/FAST CRAFT AND SHIPS Final Report
R. W. Judy, Jr. Sep. 1976 163 p refs
(AD-A031423; NRL-MR-3377) Avail: NTIS HC A08/MF A01 CSCL 13/10

This report summarizes the accomplishments of a three-year program to explore the materials aspects of structural integrity technology for fast craft and ships. Fast craft and ships of the future will be the first Navy experience with fleet ships where high-strength materials will be used in the seawater environment. In contrast to the customary naval structural materials, which are quite 'forgiving', higher strength materials have an increased tendency for accelerated crack growth, environmental effects, and fracture; the result of this tendency will be increased safety and maintenance deficiencies in critical components until sufficient technology and experience in the correct use of such materials is gained. In the three-year program, the properties of current candidate structural materials and promising developmental materials were investigated, using general fracture mechanics methods, to evolve the technology necessary for their safe and economical use in the design of future ships. The emphasis of the program was on fracture, fatigue crack growth, and stress-corrosion cracking of metals in thin-section sizes; an additional part of the program concerned similar studies of high-strength composite materials and adhesive bonding. GRA

N77-20252# Boeing Vertol Co., Philadelphia, Pa.
IMPROVEMENT OF HELICOPTER FORGINGS BY CONTROLLED SOLIDIFICATION AND THERMAL-MECHANICAL TREATMENTS Final Report, Mar. 1974 - Mar. 1976
Joseph C. Zola Oct. 1976 266 p refs
(Contract DAAA25-74-C-0448)
(AD-A031357; USAAVSCOM-76-41) Avail: NTIS HC A12/MF A01 CSCL 11/6

A four-task program was conducted to provide information for the development of industrial techniques for producing improved aluminum forgings. These techniques, involving intermediate thermal-mechanical treatment (ITMT) of ingot, were evaluated on the basis of microstructure, mechanical properties, fracture and fatigue properties, and resistance to stress corrosion. The results showed that ITMT forgings have equivalent tensile properties and stress corrosion resistance and at least 20% better fracture toughness and fatigue properties when compared to conventional 7075-T73 forgings. Author (GRA)

N77-20253# AiResearch Mfg. Co., Phoenix, Ariz.
DEVELOPMENT OF TITANIUM ALLOY CASTING TECHNOLOGY Final Technical Report, 15 Feb. 1974 - 15 Feb. 1976
Don R. Schuyler, John A. Petrusha, G. S. Hall, and S. R. Seagle
Wright-Patterson AFB, Ohio AFML Aug. 1976 311 p refs
Prepared in cooperation with RMI Co., Niles, Ohio
(Contract F33615-74-C-5055)
(AD-A031776; AiResearch-76-311721; AFML-TR-76-80) Avail: NTIS HC A14/MF A01 CSCL 13/8

This program was conducted to develop the technologies necessary to establish a low-cost approach for producing titanium investment castings. This approach was based on using simpler and cheaper melting and casting techniques, common to steel and super-alloy investment foundries, for producing high-quality, low-cost titanium castings. Program objectives included: (1) development of a low-melting titanium alloy displaying adequate tensile properties, (2) development of low reactivity ceramics for use in melting crucibles and investment mold facecoats, and (3) establishing an induction melting and vacuum casting capability using the above technologies. Alloy investigations conducted, by RMI Company, evaluated eight binary titanium alloy systems. Low melting alloys from the titanium-copper system displayed the greatest potential with the Ti-13Cu composition being selected as a base alloy for further work. Several Ti-13Cu base alloys exhibited an attractive combination of mechanical properties, heat treatment response and melting temperature. A titanium modified yttria material (Y2O3.15Ti) was developed for melting crucible applications. The concept of producing titanium castings using low-melting alloys, vacuum induction melting in a ceramic crucible, and low-reactivity investment molds, was successfully demonstrated, and offers the potential for further production of low-cost, high-quality, titanium castings. GRA

N77-20254# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A CALCULATION OF THE HIGH TEMPERATURE TRANSPORT PROPERTIES OF ZINC Ph.D. Thesis
Thomas C. Genoni May 1976 88 p refs
(AD-A031747; AFIT-CI-7T-1) Avail: NTIS HC A05/MF A01 CSCL 20/12

This document applies a Nearly Free Electron Model (NFEM) combined with a local pseudopotential approximation to the analysis of the high temperature transport properties of single crystal zinc. Within this framework, it obtains qualitative agreement

with the experimental observations of three anisotropic effects: self-electromigration, Hall effect, and diffusion thermoelectric power. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-20255*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
HIGH PURITY SILICA REFLECTIVE HEAT SHIELD DEVELOPMENT Final Report, Nov. 1973 - Sep. 1974
James C. Blome, David N. Drennan, and Raymond J. Schmitt Oct. 1974 99 p refs
(Contract NAS2-7897)
(NASA-CR-137617; MDC-E1139) Avail: NTIS HC A05/MF A01 CSCL 11G

Measurements were made of reflectance in the vacuum ultraviolet down to 0.15 micron. Scattering coefficients (S) and absorption coefficients (K) were also measured. These coefficients express the optical properties and are used directly in a thermodynamic analysis for sizing a heat shield. The effect of the thin silica melt layer formed during entry was also studied from the standpoint of trapped radiant energy. Author

N77-20256*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OXYGEN POST-TREATMENT OF PLASTIC SURFACES COATED WITH PLASMA POLYMERIZED SILICON-CONTAINING MONOMERS Patent Application
Theodore J. Wydeven, Jr. and John R. Hollahan, inventors (to NASA) (Tegal Corp., Richmond, Calif.) Filed 21 Mar. 1977 13 p
(NASA-Case-ARC-10915-2; US-Patent-Appl-SN-779883) Avail: NTIS HC A02/MF A01 CSCL 11G

The abrasion resistance of plastic surfaces coated with polymerized organosilanes is significantly improved by post-treatment of the polymerized silane in an oxygen plasma. For optical purposes, the advantages of this post-treatment are developed with a transparent polycarbonate resin substrate coated with plasma polymerized vinyltrimethoxysilane. NASA

N77-20257*# National Aeronautics and Space Administration, Washington, D.C.
CRYOGENIC ADHESIVES AND SEALANTS: ABSTRACTED PUBLICATIONS
Frank R. Williamson (NBS, Boulder, Colo.) and Neil A. Olien (NBS, Boulder, Colo.) 1977 156 p refs
(NASA-SP-3101) Avail: NTIS HC A08/MF A01 CSCL 11A

Abstracts of primary documents containing original experimental data on the properties of adhesives and sealants at cryogenic temperatures are presented. The most important references mentioned in each document are cited. In addition, a brief annotation is given for documents considered secondary in nature, such as republications or variations of original reports, progress reports leading to final reports included as primary documents, and experimental data on adhesive properties at temperatures between about 130 K and room temperature. Author

N77-20258# Massachusetts Inst. of Tech., Cambridge.
BASIC RESEARCH IN CRYSTALLINE AND NONCRYSTALLINE CERAMIC SYSTEMS Annual Report, 1 May 1975 - 1 Apr. 1976
1976 85 p refs
(Contract E(11-1)-2390)
(COO-2390-10) Avail: NTIS HC A05/MF A01

Research program activities on ceramics are reported in the areas of electric conductivity and dielectric properties, microstructure and properties, ion transport and diffusion, defect interactions and grain boundary phenomena, and future developments. ERA

N77-20259# Bendix Corp., Kansas City, Mo.
PREPARATION OF A REMOVABLE POLYURETHANE ENCAPSULANT
B. G. Parker Aug. 1976 20 p refs
(Contract E(29-1)-613)
(BDX-613-1406) Avail: NTIS HC A02/MF A01

The preparation of polyurethane encapsulants, based on polyether diol/diisocyanate prepolymers and 1,4-butanediol, which are soluble in several organic solvents, was investigated. Since these materials are easily removed, repair of electronic circuitry found defective in potted units is readily accomplished. Polyether diols of varying molecular weights were reacted with toluene diisocyanate and methylene diphenylisocyanate to produce stable prepolymers. Several properties of both the isocyanate prepolymers and 1,4-butanediol cured polyurethane encapsulants are presented. ERA

N77-20260# Bendix Corp., Kansas City, Mo.
LOW DENSITY EPOXY ENCAPSULANTS
J. M. Walker Aug. 1976 47 p refs
(Contract E(29-1)-613)
(BDX-613-1411-Rev) Avail: NTIS HC A03/MF A01

The resin, catalyst, and filler of an epoxy-hollow glass microsphere encapsulant were evaluated to solve problems associated with encapsulated electronic assemblies and an alternate source of hollow glass microspheres was selected. Specific problems related to the use of this encapsulant are discussed. The results of attempts to modify the blowing agent of an epoxy foam are also included. ERA

N77-20261# Brookhaven National Lab., Upton, N.Y.
POLYKETONES AND POLYSULFONES FOR CONSERVATION IN THE ETHYLENE POLYMER MARKET
M. Steinberg Apr. 1976 22 p refs Presented at the Meeting of the Am. Inst. of Chemical Engr., Atlantic City, 27 Aug. 1976
(Contract E(30-1)-16)
(BNL-21341; Conf-760823-5) Avail: NTIS HC A02/MF A01

There is a sizable incentive to reduce raw materials cost for basic polymer manufacture. Polyketones, synthesized from ethylene and CO, and polysulfones, synthesized from ethylene and SO2, utilizing high energy radiation, offers one such possibility. CO and SO2, usually considered as wastes and pollutants from fossil fuel burning power plants, are converted to useful materials. The polyketones and polysulfones formed from the gas phase below 100 C are found to be high molecular weight polymers which, depending on composition, either melt with difficulty, or decompose at temperatures of 250 C or higher. The higher temperature (greater than 100 C) catalyzed reaction produces low molecular weight waxes. Design calculations indicate that for a G value of 10,000 and 50 percent energy deposition efficiency, it would take 331 MCi of Co-60 to conserve 2 billion pounds of ethylene or 25 percent of the overall U. S. consumption in the PE market by substituting CO and SO2. ERA

N77-20262# Scientific Translation Service, Ann Arbor, Mich.
SODIUM-RESISTANT SOLDERS FOR METAL-CERAMIC JOINTS
T. Reetz Jul. 1976 20 p refs Transl. into ENGLISH from Schweisstech. (Berlin), v. 24, no. 2, 1974 p 74-77 Prepared for Argonne Natl. Lab., Ill.
(Contract W-31-109-eng-38)
(ANL-Trans-1061) Avail: NTIS HC A02/MF A01

Selection of sodium-resistant solder alloys for a joint between ThO2-20 mole percent Y2O3 and Dilasil (51 Fe, 48 Ni, 1 Cr) is described. The solder material selected was Ni-Ga, and soldering at 1250 C produced joints which remained vacuum tight even after several thermal cycles to 450 C. ERA

N77-20263# Oak Ridge Y-12 Plant, Tenn. Dept. of Chemistry Development.
SYNTHETIC-PITCH BINDERS BY AUTOCLAVE POLYMERIZATION OF ORGANICS
W. E. Smith and B. Napier, Jr. 28 Jun. 1976 25 p refs
(Contract W-7405-eng-26)
(Y-2042) Avail: NTIS HC A02/MF A01

Polymers prepared by autoclave heat treatment of simple hydrocarbons were evaluated as sources of synthetic pitches for use in fabricating composite carbons. Hydrocarbons included: indene, phenanthrene triphenylbenzene, 1,4-diphenyl-1,3-butadiyne, and cinnamylideneindene. Autoclave temperatures and pressures were in the ranges of 340 to 515 C

and 5 to 28 MPa, respectively. The more promising pitch materials were liquids or low-melting solids with coke yields of approximately 50 weight percent. Binary mixtures of organics were able to produce polymers and resulting carbons with properties that were correlated to the composition of the organic blend, thus allowing the controlled modification of properties. ERA

N77-20264# Sandia Labs., Albuquerque, N.Mex.
TECHNIQUE FOR DETERMINING RELAXATION FUNCTIONS IN LINEAR VISCOELASTIC MATERIALS
A. M. Lindrose 1976 5 p refs Sponsored by ERDA
(SAND-75-5458) Avail: NTIS HC A02/MF A01

An isotropic linear viscoelastic material undergoing a continuous uniaxial loading is described by Volterra integral equations of the first kind in which the kernels represent shear, bulk, and Young's moduli. The determination of these moduli using stress and strain histories other than those of step response are considered. A modified direct quadrature is used in the constitutive characterization of real materials. Experimental sinusoidal uniaxial stress data for low-density polyethylene show that the trend curves are biased in favor of the relaxation moduli of polyethylene at less than 1 percent strain. Author (ERA)

N77-20265# Bendix Corp., Kansas City, Mo.
INVESTIGATION OF NEW ENGINEERING THERMOPLASTICS
C. L. Walter Aug. 1976 11 p refs Revised
(Contract E(29-1)-613)
(BDX-613-1425-Rev) Avail: NTIS HC A02/MF A01

The nine newly developed injection molding materials were characterized chemically, and several of their physical properties were determined. These materials each have special characteristics which make them suitable for particular applications. Polyphenylene sulfide, methylpentene polymer, four proprietary thermoplastic polyester molding resins, plus both glass-filled polycarbonate and polyester injection moldable structural foam systems were evaluated. ERA

N77-20266# California Univ., Livermore. Lawrence Livermore Lab.
PROPERTIES OF THREE ADIPRENE-BASED ADHESIVES
H. George Hammon and Norriss Hetherington 1 Apr. 1976 46 p refs
(Contract W-7405-eng-48)
(UCRL-52044) Avail: NTIS HC A03/MF A01

Properties of Adiprene L-100, Adiprene L-315, and Adiprene LW-520 are reported. Information is included on cure rates, adhesive properties, tensile properties, shear rate temperature dependence, gas permeability, thermal expansion, transition temperature, density, chemical composition, and handling precautions. Author (ERA)

N77-20267# Bendix Corp., Kansas City, Mo.
EVALUATION OF SYNTACTIC POLYSULFIDE STRESS RELIEF COATINGS
T. E. Neet Aug. 1976 28 p refs
(Contract E(29-1)-613)
(BDX-613-1205-Rev) Avail: NTIS HC A03/MF A01

The effect of phenolic microballoons on the pot life of syntactic polysulfide was evaluated. Material formulations and processing parameters were studied to develop procedures for applying a stress relief coating on electrical components to adequately protect these assemblies from stresses applied by the glass microballoon-filled encapsulating material. The static stress-strain as well as the bulk modulus characteristics of the syntactic polysulfide were evaluated. Cure schedules for the polysulfide were investigated. ERA

N77-20268# Heimann G.m.b.H., Wiesbaden (West Germany).
BASIC MATERIAL FOR PYROELECTRIC DETECTORS Final Report
Peter W. Steinhage Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1976 55 p refs In GERMAN; ENGLISH summary Succeedes BMFT-FB-T-75-05; N76-13466 Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-76-61; BMFT-FB-T-75-05) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 11.55

Several pyroelectric materials were investigated with respect to their suitability as basic materials in pyroelectric detectors. Measured bulk material parameters were compared and the derived predictions tested by means of detector samples. The average performance data of the detectors are reported. In the low and middle frequency region the highest detectivities are achieved by using triglycinesulfate and lithiumalanine triglycinesulfate. In addition lithium tantalate was found to be a suitable basic material for applications both at very low and very high frequencies. Strontiumbarium-niobate is preferably used in fast response detectors with edge electrode configuration. Lead titanate and leadzirconiumtitanate (0.07)- ceramics exhibit more disadvantageous specific material parameters. In some cases doping was found to have lowering effects on the detectivity by causing an increase of the element noise and the specific heat. Author (ESA)

N77-20269# Battelle Columbus Labs., Ohio.
SURVEY OF COMMERCIALLY AVAILABLE CHEMICAL COATINGS Final Report, Jun. - Oct. 1975
M. Luttinger, J. M. Spangler, D. L. Hill, and J. A. Wray Apr. 1976 32 p refs
(Contract DAAA15-75-C-0176)
(AD-A031611; ED-CR-76038) Avail: NTIS HC A03/MF A01 CSCL 15/2

Treating the silicone rubber surface of the Edgewood Arsenal face mask with an oxidizing flame improved wetting and adhesion properties of the silicone. Daran X-226, Alfa 1059, and Cyplex 1600 can act as primers on the silicone surface because of their good adhesion. Several potential barrier coatings were evaluated. Kynar Cyplex or Humiseal 1F54 may be used as top coat since each can increase barrier properties. Author (GRA)

N77-20270# Research Triangle Inst., Research Triangle Park, N.C.
A STUDY OF GLOW DISCHARGE POLYMERIZATION AS A MEANS OF MODIFYING THE SURFACE OF POLYMERS Annual Report, 1 Dec. 1975 - 31 Jul. 1976
H. Yasuda 14 Aug. 1976 51 p refs Sponsored by Natl. Heart and Lung Inst., Bethesda, Md.
(PB-259106/3; NIH-N01-HB-3-2193-4) Avail: NTIS HC A04/MF A01 CSCL 07C

Surfaces of polymers treated by Ar and N2 plasma and of glow discharge polymerized polymers were investigated by electron spectroscopy for chemical analysis (ESCA). A method to coat the inside of small diameter tubing was established, and the distribution of coating in a tube was examined. It is possible to coat the inside of 8-10 mm I.D. tubing of length 12 in. by the method. The The internal stress build up in the coating layer formed by glow discharge polymerization was investigated by the measuring curling of a composite film. Using this method, characteristic internal stress in some plasma polymers was compared. Glow discharge polymer of tetramethyldisiloxane seems to yield relatively less internal stress compared to other monomers. GRA

N77-20271# Aeronutronic Ford Corp., Newport Beach, Calif. Aeronutronic Div.
THERMAL PROTECTIVE COATINGS Final Report, 11 Dec. 1974 - 31 Mar. 1976
J. L. Perry and G. R. Wittman 31 Mar. 1976 68 p
(Contract N00123-75-C-0655)
(AD-A031035; U-6213) Avail: NTIS HC A04/MF A01 CSCL 11/3

An exploratory research and development program was performed for the purpose of providing an effective thermal barrier for aircraft and pilot protection in the event of an aircraft fire. The primary objective of the program was Task I, which consisted of examining the effectiveness of expanding naturally occurring fillers (Perlite and Vermiculite) when used in combination with organic and inorganic matrix coating systems. Both filler systems expand and increase in volume up to 20 times when exposed to heat and liberate no toxic gases. Thin coatings of these filler systems combined with various organic intumescent paints and inorganic matrix systems were developed and thermally evaluated. Test specimens were exposed to a frontface thermal flux environment of 13.5 BTU/ft sq ft--sec (15.3 joules/sq cm--sec) within the door opening of an electric furnace while the aluminum substrate specimen backface temperature rise with respect to

time of exposure was continuously monitored and autographically recorded. The most effective thermal coating developed was composed of an intumescent paint, No. 3 grade Vermiculite and 0.5 inch (1.27 cm) length graphite fiber in the respective ratios of 65.8 percent, 33.9 percent, and 0.03 percent by weight. This coating when applied at a thickness of 0.060 inch (0.15 çm) to an aluminum substrate and tested as described will insulate the substrate for a period of 6.8 minutes before a temperature of 500 F (260 C) is reached and for a period of 17.4 minutes before a temperature of 800 F (427 C) is reached. Task II consisted of thermally characterizing 60 government furnished ceramic felts by exposing them to a thermal flux of 15 BTU/f sq ft.--sec. GRA

N77-20272# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SYNTHESIS AND PROPERTIES OF AROMATIC POLYIMIDES CONTAINING THE SIX-MEMBERED RING SYSTEM Final Technical Report, Mar. 1973 - Apr. 1974
G. A. Loughran and F. E. Arnold Jun. 1976 35 p refs
(AF Proj. 7340)
(AD-A030877; AFML-TR-76-27) Avail: NTIS
HC A03/MF A01 CSCL 07/3

This work was performed to determine the best synthetic procedure for the preparations of six-membered polyimides, and the extent to which processability parameters such as solubility and fusibility could synthetically be altered in the polymer system. The six-membered imide ring system has excellent hydrolytic stability in highly corrosive solvents, both acidic and basic; however, the system has not been prepared in high molecular weight due to the 'perc' effect of the dianhydride monomers. A number of new aryleneoxy and arylenethio-bis-'pere' anhydrides have been synthesized for use as monomers for the preparation of soluble and fusible polyimides containing six-membered rings. The bis-anhydrides were converted to polyimides by solution polycondensation with oxyarylenediamines. The polyimides were soluble in m-cresol and exhibited glass transition temperatures in the 260-360 C range. All of the polymers displayed good thermal and thermal oxidative properties; although high molecular weights were not achieved. Author (GRA)

N77-20273# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
IMPACT RESISTANCE OF STRUCTURAL CERAMICS. PART 1: INSTRUMENTED DROP-WEIGHT TESTS Interim Report, Jun. 1975 - Jun. 1976
I. Bransky, James M. Wimmer, and Norman M. Tallan May 1976 72 p refs
(AF Proj. 7021)
(AD-A030878; AFML-TR-76-56-Pt-1) Avail: NTIS
HC A04/MF A01 CSCL 11/2

Two mechanisms can lead to failure of ceramics under impact, (1) failure due to flexural stresses, and (2) failure due to Hertzian type cracks introduced locally by the impactor. An instrumented drop-weight test designed to study failure due to flexural stresses is described and used to study various forms of silicon nitride and silicon carbide up to 1300 C. Results on alumina and sialon are included for comparison. From the standpoint of impact resistance hot-pressed silicon nitride is the best material. Author (GRA)

N77-20274# Construction Engineering Research Lab. (Army), Champaign, Ill.
REVIEW OF FORMULATION AND TESTING PROCEDURES FOR COAL TAR EPOXY (SSPC PAINT 16-68T) Final Report
A. Beitelman Sep. 1976 56 p
(AD-A030566; CERL-TR-M-19223) Avail: NTIS
HC A04/MF A01 CSCL 11/3

The Corps of Engineers uses the Steel Structures Painting Council (SSPC) specification 16-68T for coal tar epoxy paint extensively. Although performance of the material is unquestioned, difficulty in obtaining the coal tar pitch used in its manufacture has been experienced during energy shortages; this problem has stimulated efforts to revise the specification. This study critically examined the test methods and requirements set forth in the specification and evaluated several pitches as possible replacements. It is recommended that the sag test be simplified without altering the test requirement; that the nonvolatiles requirement be altered if a proposed change in the packaging ratio is implemented; and that coal tar pitch RT-12 be used as a replacement for the pitch now specified--if requirements can be written to provide a pitch with a minimum of water-extractable material, and if the odor requirement of the present specification is eliminated. Author (GRA)

N77-20275# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
EFFECT OF STRUCTURE ON PHYSICAL PROPERTIES OF POLYMERS Final Report, 1 Nov. 1971 - 29 Feb. 1976
Frank E. Karasz 1976 31 p
(Grant AF-AFOSR-2170-72; AF Proj. 9536)
(AD-A031012; AFOSR-76-1104TR) Avail: NTIS
HC A03/MF A01 CSCL 07/3

The effect of stereochemical configuration in poly-alpha-chloroacrylic acid esters was studied principally with respect to the glass and other transitional properties. A substantial dependence of glass transition temperature on tacticity as theoretically predicted was found. The interaction of small molecules, principally water, with a series of segmented polyurethanes of systematically varied structure was investigated by transport, sorption and calorimetric measurements. Analysis in terms of 'bound' water models revealed cogent evidence for the amorphous nature of the adsorbate. A very sensitive measure of the effect of structure was found in a series of polymer miscibility studies on several chemically related binary systems which included poly(2,6-dimethyl phenylene oxide) (PPO)-polystyrene (PS). Thermodynamic, electrical, and mechanical properties of compatible and near-compatible systems were investigated in detail. Mechanical properties of solid polymers such as polymethyl solid polymers methacrylate under hydrostatic pressure were determined principally with respect to the transitional behavior of the amorphous phase. The effect of pressure on the equilibrium properties of the crystalline phase (high density polyethylene) was studied in a concomitant wide angle X-ray diffraction experiment. In a second dynamical mechanical study, compound flexural vibrations in thick beams of polymethyl methacrylate were measured and analyzed. It was shown that the contributions of shear and elongational deformations could be resolved thereby providing a complete isotropic elastic characterization of materials in such configurations. GRA

N77-20276# Amoco Chemicals Corp., Seymour, Ind.
DEVELOPMENT OF LARGE SCALE PLASTIC EXTRUSIONS Final Technical Report, Dec. 1968 - Dec. 1973
James E. Aker, Joseph L. Weingarten, Lawrence E. Fielding, and Edward J. Morrisey Wright-Patterson AFB, Ohio AFML Apr. 1976 92 p
(Contract F33657-70-C-0884)
(AD-A032142; AFML-TR-76-50) Avail: NTIS
HC A05/MF A01 CSCL 13/8

This report details the development of an extrusion process and refers to a pallet for background. Utilizing a 3 1/2 inch extruder, structural shapes 2 1/4 inches thick by 101 inches wide by 9 feet in length were extruded. A significant advancement in the state-of-the-art of large scale polymer extrusions was accomplished in this program. Development effort to date has effectively shown that large scale extrusions of thermoplastics can be achieved. While feasibility has been proved, economic utilization of this technology will require further improvements to speed the extrusion process. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-20277# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Mechanical, Industrial and Aerospace Engineering.
IGNITION AND PROPAGATION RATES FOR FLAMES IN A FUEL MIST Final Report, Jan. 1975 - Jan. 1976

C. E. Polymeropoulos and V. Sernas Nov. 1976 55 p refs Prepared in cooperation with the Natl. Aviation Facilities Experimental Center
(AD-A034224/6; FAA-NA-76-162; FAA-RD-76-31) Avail: NTIS HC A04/MF A01 CSCL 21/4

The droplet size distribution in various experimental air-fuel sprays was measured using a holographic method. There was good agreement between upper-limit log-normal velocity distribution functions and the droplet size data. The Sauter mean diameter, maximum droplet diameter, and air-fuel ratio were also well represented at the data. Measurements of burning velocities in the sprays tested were compared with calculated predictions, and the results were satisfactory. Approximate burning velocities in modified fuel sprays produced under wind shear conditions were also calculated. Author

N77-20278# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
POSSIBILITIES OF GUN POWDER RESEARCH AT THE TNO TECHNOLOGY LABORATORY [OVERZICHT VAN MOGELIJKHEDEN VAN KRUITONDERZOEK OP HET TECHNOLOGISCH LABORATORIUM TNO]
E. Jilderda and J. L. C. VanGeel 10 Mar. 1976 20 p refs In DUTCH
(TL-1976-2; TDCK-67691) Avail: NTIS HC A02/MF A01

Various possibilities are reviewed. Topics include stability investigation, chemical analysis, bomb tests, combustion rate determination, hygroscopicity investigation, and grain size determination. ESA

N77-20279# Naval Research Lab., Washington, D.C.
PRO-STATIC AGENTS IN JET FUELS Final Phase Report
J. T. Leonard and H. F. Bogardus 16 Aug. 1976 39 p refs Sponsored in part by the American Petroleum Inst.
(NRL Proj. C05-19A)
(AD-A029382; NRL-8021) Avail: NTIS HC A03/MF A01 CSCL 21/4

The effects of a wide variety of polar compounds and fuel additives on both the electrical conductivity and electrostatic charging tendency of both silica gel treated n-heptane and Jet A fuels have been examined. Conductivity was determined by ASTM D3114 and charging tendency by measuring the current developed as the hydrocarbon liquid passed through an electrically isolated filter holder containing a paper, fiberglass or teflon screen filter. Of all the compounds and additives tested, water came closest to fulfilling the definition of an ideal pro-static agent, viz, a compound that greatly increases the charging tendency of a fuel without increasing its conductivity. After saturation with water, the charge density of clay-treated Jet A fuel increased by a factor of 23 and that of an untreated Jet A by a factor of 7. The conductivities of both fuels remained essentially the same. Since water did not increase the charging tendency or conductivity of silica gel-treated n-heptane it was concluded that it is not water per se, but rather its interaction with some constituent in the jet fuel that is responsible for its pro-static effect. GRA

N77-20280# Battelle Columbus Labs., Ohio.
FUEL CONTAMINANTS. VOLUME 2: REMOVAL TECHNOLOGY EVALUATION Final Report, Jun. 1975 - Apr. 1976
E. J. Mezey, Surjit Singh, and D. W. Hissong Sep. 1976 318 p refs
(Contract EPA-68-02-2112)
(PB-260475/9; EPA-600/2-76-117B) Avail: NTIS HC A14/MF A01 CSCL 21D

Methods used to remove sources of sulfur, nitrogen, and trace element pollutants from coal, coal liquids, petroleum, tar sand oils, and shale oils are reviewed. The evaluation is restricted to systems that remove contaminants before combustion. The survey identifies contaminant removal methods which were used successfully in the past, are used now, or which, although previously unsuccessful, might be used successfully today. The evaluations generally indicate that no single method is effective for removing all of the contaminants from the fuels under consideration, yet permitting the fuel to be recovered unaltered in form and quality. GRA

N77-20281# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT LGM-30 A AND B STAGE I, TP-H1011 Semiannual Report
John A. Thompson Sep. 1976 93 p refs
(AD-A031405; MANCP-351(76)) Avail: NTIS HC A05/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 A and B First Stage Minuteman Motors. This report is the eleventh time that a statistical approach has been used to analyze First Stage bulk carton propellant. Testing was accomplished in accordance with MMEMP Project M72632-5MP116P. The purpose of testing was to determine and provide early warning of any serious degradation trends occurring in the propellant for service life predictions. An analysis of all parameters indicates that no potential problems are expected in the propellant for at least two years past the oldest data point. Data stored in the GO85 System were plotted utilizing the IBM 360-65 Computer and CAL-COMP Plotter. The data range at any age can be found by suitable inquiry of the GO 85 System. Each point on the regression plot represents the mean of all samples at that particular age. The number of specimens at each point is indicated on the sample size summary sheet accompanying each regression plot or group of regression plots. Author (GRA)

N77-20282# Naval Surface Weapons Center, White Oak, Md.
ALTERNATE SOURCES FOR PROPELLANT INGREDIENTS Final Report, period ending 30 Jun. 1976
M. E. Houser and M. I. Fauth 7 Jul. 1976 34 p refs
(SF3132307)
(AD-A031097; NSWC/WOL/MP-76-19) Avail: NTIS HC A03/MF A01 CSCL 19/1

A survey has been made to evaluate the criteria which determine whether the supply status of a substance required for the production of propellants and related Navy materials is critical, and for which materials alternate sources are required or should be developed. Lists of materials are presented for the following categories: (1) not commercially available and presently manufactured or processed at the Naval Ordnance Station, Indian Head; (2) commercially available but supply problems exist for a variety of reasons; (3) sole source; (4) medical/OSHA/EPA problems; (5) dependent on foreign imports; and (6) specification problems. GRA

N77-20283# Naval Weapons Support Center, Crane, Ind.
BLACK NITE FLARE
Carl W. Lohkamp 2 Sep. 1976 15 p refs
(AD-A030713; NWSC/CR/RDTR-39) Avail: NTIS HC A02/MF A01 CSCL 19/1

The Army and the Navy have and are using image intensifiers and low light level televisions (LLLTV). These items are used at all levels, that is, from individual soldier in the Army to part of the fire control directorate for the TARTAR missile system in the Navy. These electro-optical (EO) devices, however fail to perform adequately under 1/4 moon or less natural illumination conditions. The EO image intensifiers and LLLTV devices which are now in or are soon to be in service utilize the S-1, improved S-20, or the S-25 photoemitter surfaces. Examination of these responses shows that the performance of the EO devices can be enhanced by visible and near infrared flux. Discussion of several compositions having peak emissions in the near infrared portion of the spectrum is included as well as reflectance data on natural terrain. Testing of these compositions in the laboratory as well as in the field has been completed. Flare output data for the visible and infrared portion of the spectrum are included in the report. Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-20284# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
CONVERSION OF SELECTED MILITARY FORCES TO THE USE OF METRIC MEASUREMENT UNITS M.S. Thesis. Final Report

Gordon L. Boozer 11 Jun. 1976 94 p refs
(AD-A029707) Avail: NTIS HC A05/MF A01 CSCL 05/1

Conversion of the United States military to the International System of measurement units is in the very early stages. Little formal planning has been done to articulate the management required to complete the conversion of operational Army and Air Force units. For those operational forces tasked to provide continuous combat readiness throughout metrication, management problems associated with the conversion are particularly difficult because of the nature of these assigned missions. This is the case for the 82nd Airborne Division ready brigade force (DRB) and the Military Airlift Command (MAC) strategic airlift system operating the C-141 and C-5A aircraft. GRA

N77-20285# National Bureau of Standards, Boulder, Colo. Lab. Astrophysics Div.

NATIONAL MEASUREMENT SYSTEM FOR THE PHYSICAL PROPERTIES OF ATOMS AND MOLECULES

J. W. Cooper, A. V. Phelps, and S. J. Smith Sep. 1976 39 p refs
(PB-258372/2; NBSIR-75-944) Avail: NTIS HC A03/MF A01 CSCL 05A

The interface with the user community is explored, and questions are raised concerning the roles of the measurement of atomic and molecular properties as an element of the national measurement system. Recent changes in the technological and economic environment which affect all of atomic and molecular physics are recognized. The functions of NBS atomic and molecular physics programs, especially as they relate to this interfacing role and the uniqueness of the NBS fullment of the role, are considered. GRA

N77-20286# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

LIFT AND DRAG CHARACTERISTICS OF NACA 16-3-09 AND NACA 64A309 HYDROFOILS Final Report

Douglas E. Layne Oct. 1976 103 p refs
(AD-A032272; SPD-326-07) Avail: NTIS HC A06/MF A01 CSCL 13/10

Lift and drag data were obtained by the David W. Taylor Naval Ship Research and Development Center (DTNSRDC) for two NACA foil shapes geometrically similar to the forward foil system of the PCH hydrofoil craft. The NACA foil shapes were the 16-309 (presently used on PCH) and a modified 64A309 section. Information was obtained for flap angles up to 17.5 degrees and pitch angles up to 12 degrees. There was good agreement between similar measurements made in the High-Speed Tow Facility and in the Rotating Arm Facility. Experimental results indicate that the 64A309 foil can achieve a higher lift-to-drag ratio than the 16-309 foil. Although the angle of pitch at which cavitation inception occurred was approximately the same for the two foils, the inception occurred at a higher lift for the 64A309. The 64A309 section produced more lift with changes in flap angles than did the 16-309 section. Flap effectiveness decreases at the larger flap angles as velocity is increased. Depth of submergence of the foils noticeably influenced lift and drag, particularly at depths less than one chord length of the foil. Author (GRA)

N77-20287# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.

TRANSACTIONS MATRIX DESCRIPTION OF THE NATIONAL SYSTEM OF PHYSICAL MEASUREMENTS

Raymond C. Sangster Aug. 1976 90 p
(PB-258914/1; NBSIR-75-943) Avail: NTIS HC A05/MF A01 CSCL 14B

The interactions among the various elements of the National Measurement System are described in a series of transactions matrices. The National Measurement System consists of all of the activities and mechanisms used by the United States to produce measurement data. The transactions matrices describe both the flow of measurement knowledge, goods, and services from suppliers to users in the system, and the activities within a given supplier-user sector. Semiquantitative estimates are made for the magnitude of the transactions, the rate of change of that magnitude, the relative importance or criticality of the transactions, and their adequacy. GRA

N77-20288# Franklin Inst. Research Labs., Philadelphia, Pa.

METHODS FOR MONITORING INITIATING SOURCES GENERALIZED IN PYROTECHNIC PROCESSING EQUIPMENT Final Contractor's Report

Charles T. Davey Sep. 1976 90 p refs
(Contract DAAA21-74-C-0497)
(AD-A030754; PA-TR-4981) Avail: NTIS HC A05/MF A01 CSCL 19/1

Conditions leading to an accident in batch processing of pyrotechnic materials were investigated. Levels of temperature, impact, friction, and electrostatic energy were defined for five typical pyrotechnic materials. The most sensitive of these materials yielded the following thresholds: temperature, 510 C; impact, 41 in-lb; friction, 10 to the eight power Newtons/square meter, and electrostatic energy, 29 millijoules. Means of detecting these levels of driving force were sought for processing operations currently used: mixing, blending, granulating, pressing and drying. A sound (IMS) system is outlined for further testing and control. This system should permit the earliest possible detection of potential problems and allow more time to act on a potentially hazardous situation. Author (GRA)

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N77-20289* National Aeronautics and Space Administration. Pasadena Office, Calif.

MULTIPLE RATE DIGITAL COMMAND DETECTION SYSTEM WITH RANGE CLEAN-UP CAPABILITY Patent

James R. Lesh (JPL) and Stanley A. Butman, inventors (to NASA) (JPL) Issued 15 Mar. 1977 14 p Filed 17 Feb. 1976 Supersedes N76-18826 (14 - 09, p 1174) Sponsored by NASA
(NASA-Case-NPO-13753-1; US-Patent-4,012,696; US-Patent-Appl-SN-658449; US-Patent-Class-325-4; US-Patent-Class-343-6.5R; US-Patent-Class-343-6.8R; US-Patent-Class-343-100ST) Avail: US Patent Office CSCL 17B

A multi-rate digital command system is disclosed which uses the composite signal of a mu-type ranging system as a subcarrier to transmit range codes and data from a station to a receiver where the range codes are sequentially phase modulated on a subcarrier of frequency by one of its own subharmonics and data is phase modulated on a selected ranging component. A range cleanup loop in a spacecraft locks the phase of a locally generated reference component to a received ranging component and retransmits the component to a ground station. When the inverse phase of a ranging component is received and detected, the cleanup loop is modified to demodulate phase modulated command symbols while continuing tracking the same ranging component. The command symbol rate is coherently related to the ranging signal component bit rate.

Official Gazette of the U.S. Patent Office

N77-20290*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PUBLIC SERVICE COMMUNICATIONS SATELLITE USER REQUIREMENTS WORKSHOP Final Report

Edward A. Wolff 14 Jan. 1977 462 p
(NASA-TM-X-74629) Avail: NTIS HC A20/MF A01 CSCL 17B

Information on user requirements for public service communications was acquired to provide the basis of a study to determine the optimum satellite system to satisfy user requirements. The concept for such a system is described: Topics discussed included requirements for data and message services, elementary and secondary education, extension and continuing education, environmental communications, library services, medical education, medical services, public broadcasting, public safety, religious applications, state and local communications, and voluntary services. Information was also obtained on

procedures to follow to make the transfer to commercial services. Author

N77-20291*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THEORETICAL AND SUBJECTIVE BIT ASSIGNMENTS IN TRANSFORM PICTURE
Harry W. Jones, Jr. Washington Mar. 1977 17 p refs
(NASA-TN-D-8440; A-6781) Avail: NTIS HC A02/MF A01 CSCL 05B

It is shown that all combinations of symmetrical input distributions with difference distortion measures give a bit assignment rule identical to the well-known rule for a Gaussian input distribution with mean-square error. Published work is examined to show that the bit assignment rule is useful for transforms of full pictures, but subjective bit assignments for transform picture coding using small block sizes are significantly different from the theoretical bit assignment rule. An intuitive explanation is based on subjective design experience, and a subjectively obtained bit assignment rule is given. Author

N77-20292# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DATA LINK SUBSYSTEM LABORATORY TESTS Final Report, Oct. - Nov. 1974
Anthony J. Swezeny Nov. 1976 21 p refs
(AD-A033050/6; FAA-NA-75-29) Avail: NTIS HC A02/MF A01 CSCL 17/2

Various very high frequency (VHF) transmitter-receiver combinations were used with minimum shift key (MSK) modems for bit error rate tests at 2400 and 4800 bit/second (b/s) rates and at various radiofrequency (RF) noise density levels over a simulated RF digital data link. Results indicated that to obtain the same bit error rate performance, the energy to noise (E/No) requirements differed up to 3.5 dB at 2400 b/s and up to 6 dB at 4800 b/s for the various transmitter-receiver combinations in the ground/air channel. Author

N77-20293# Office of Telecommunications, Boulder, Colo.
VOICE CHANNEL OBJECTIVE EVALUATION USING LINEAR PREDICTIVE CODING Final Report
W. J. Hartman and S. F. Boll (Utah Univ., Salt Lake City) Aug. 1976 50 p refs
(Contract DOT-FA74WAI-448)
(AD-A033725/3; FAA-RD-75-189) Avail: NTIS HC A03/MF A01 CSCL 17/2

A feasibility study was done on the use of linear predictive coding (LPC) techniques for deriving an objective measure of intelligibility over voice communication channels. Background material is given and several potentially useful measures are identified. The limitations of the present study are detailed and methods of overcoming these limitations in future work are outlined. In spite of these limitations, the study strongly supports the suitability of LPC techniques for the objective measurement of intelligibility. Author

N77-20294# Georgia Inst. of Tech., Atlanta.
ELECTROMAGNETIC COMPATIBILITY PROGRAM PLAN
J. C. Toler Apr. 1976 58 p refs
(Contract DOT-FA74WA-3372)
(AD-A032474/9; FAA-RD-76-75) Avail: NTIS HC A04/MF A01 CSCL 09/3

Recommendations are given to the Federal Aviation Administration regarding management and engineering considerations of importance in establishing an agency-wide Electromagnetic Compatibility Program. A program terminology is therefore developed in which precise definitions are provided for commonly used terms, e.g., EC, Electromagnetic Interference, and Electromagnetic Susceptibility. These definitions show that each of these terms has a distinctive meaning and that any interchangeable use of them leads to misunderstandings. The program philosophy is focused entirely On realizing the ultimate goal of system level compatibility. All management and engineering efforts must be related to achieving this ultimate goal or they have no justification. From an engineering point-of-view, strong and equal emphases on a priori design and a posteriori test efforts are recommended. Management techniques and tools as they influence the EC organization and its responsibilities are also identified. Author

N77-20295# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ELECTROMAGNETIC COMPATIBILITY RATIONALE REPORT: RADIATED TEST
J. C. Toler and J. A. Woody Apr. 1976 214 p refs
(Contract DOT-FA74WA-3372)
(AD-A033292/4; FAA-RD-76-70) Avail: NTIS HC A10/MF A01 CSCL 09/3

The technical efforts and conclusions resulting from an investigation of requirements for a radiated and conducted electromagnetic emission and susceptibility test standard applicable to equipments in air transportation facilities are summarized. Recommendations are provided regarding the tests that should be performed, acceptable test configurations and procedures, applicable frequency ranges and performance limits. The recommended test configurations, procedures and performance limits, when properly imposed on equipment procedures, are manifested as improved flight safety, scheduling, and reliability. Author

N77-20296# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ELECTROMAGNETIC COMPATIBILITY RATIONALE REPORT: CONDUCTED TEST REQUIREMENTS FOR ELECTRONIC EQUIPMENTS IN AIR TRANSPORTATION FACILITIES
J. C. Toler, J. A. Woody, and C. L. Espy Apr. 1976 145 p refs
(Contract DOT-FA74WA-3372)
(AD-A033251/0; FAA-RD-76-69) Avail: NTIS HC A07/MF A01 CSCL 09/3
For abstract, see N77-20295.

N77-20297# National Aviation Facilities Experimental Center, Atlantic City, N. J.
OPERATIONAL AND TECHNICAL ANALYSIS GTE/WESCOM KEY/AUTOMATIC CALL DISTRIBUTOR COMMUNICATION SYSTEM, PORTLAND, OREGON, FLIGHT SERVICE STATION Final Report, Oct. 1975
Richard K. Ohman and Edward M. Sawtelle Nov. 1976 121 p
(AD-A033052/2; FAA-NA-76-11; FA-RD-76-148) Avail: NTIS HC A06/MF A01 CSCL 17/2

Field test and evaluation of the Portland, Oregon, Flight Service Station (FSS) GTE/WESCOM Key/Automatic Call Distributor Communication System (ACD) were accomplished to determine the applicability of the equipment as a system to be specified for high-activity FSS's. The system test and evaluation were accomplished by (1) evaluation of normal facility operation, (2) conduct of scripted tests, (3) analysis of FSS specialist's responses to questionnaires, and (4) analysis of operational failure logs and equipment design. Onsite observation of frequent circuit failure attributable to either system logic error, fabrication error, or integrated circuit chip failure led to the conclusion that the system did not function reliably and that such integrated circuit ACD systems should be given standard engineering and operational tests in a laboratory environment. Author

N77-20298# National Aviation Facilities Experimental Center, Atlantic City, N. J.
AN INVESTIGATION INTO THE CAPABILITY OF MONITORING A PHASED OPEN-ARRAY ANTENNA Final Report, Sep. - Oct. 1975
Nicholas J. Talotta Oct. 1976 56 p
(AD-A033055/5; FAA-NA-76-25; FA-RD-76-150) Avail: NTIS HC A04/MF A01 CSCL 17/9

A requirement exists to develop a monitoring capability for air traffic control radar beacon system ground station equipment. Tests of the Hazeltine open array antenna were performed to determine if it can be monitored in the electrical near field of the antenna. Comparison type data were obtained in the electrical near- and far-field of the antenna. The data indicate that the antenna can be monitored in the near field. Author

N77-20299*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
VERY NARROW BAND WIDTH RECEIVER Patent Application
Paris H. Wiley (Va. Polytechnic Inst. and State Univ.) and Eugene A. Manus, inventors (to NASA) (Va. Polytechnic Inst. and State Univ.) Filed 4 Mar. 1977 18 p
(NASA-Case-GSC-12142-1; US-Patent-Appl-SN-774553) Avail: NTIS HC A02/MF A01 CSCL 17B

A very narrow band width receiver, substantially unresponsive to noise imposed on a very low level signal is disclosed. It comprises a switch responsive to a replica of tthe signal and a reference wave having the same frequency as a carrier for the signal applied to the switch. the switch passes the signal only during one half of each cycle of the reference wave. A low pass filter, including an operational amplifier, responds to the input signal, as passed by the switch, to derive a DC signal having a magnitude indicative of the phase difference between the input signal and the phase controlled wave. NASA

N77-20300*# Hughes Aircraft Co., Culver City, Calif. Radar System Group.
METEOROLOGICAL RADAR FACILITY (MRF) SLOT CONDUCTANCE INVESTIGATIONS Final Report, 21 Jun. - 21 Dec. 1976
A. E. Ratkevich Jan. 1977 93 p refs
(Contract NAS5-23621)
(NASA-CR-152465; P77-20; HAC-Ref-D7036) Avail: NTIS HC A05/MF A01 CSCL 17I

A preliminary meteorological radar facility (MRF) array design was completed in support of the slot conductance measurement program. Three different slot measurement techniques were evaluated. The selection of the probe comparison measurement technique was selected as the principal experimental method with the impedance measurement technique chosen to measure a few higher conductance slots to be used as reference slots. The impedance of 43 slots in 0.9 x 0.4 inch standard waveguide and of 40 slots in 0.835 x 0.4 inch waveguide was measured. Also, impedance measurements were made of a few slots using image planes to simulate mutual coupling effects. The measured and theoretical conductance, susceptance, and radiation phase data are presented in graphic form as a function of slot displacement for constant slot length, and of slot length for constant slot displacement. It is concluded that the proposed MRF array design approach is a feasible one. Author

N77-20301# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
INSTANTANEOUS VALUE- AND SYLLABLE COMPANDED ADAPTIVE DELTA MODULATION [MOMENTANWERT- UND SILBENKOMPANDIERTE ADAPTIVE DELTA-MODULATION]
Juergen Kuehlwetter, Bruno Stork, and Guenter Weick Jun. 1976 36 p refs In GERMAN
(IND-FB-91) Avail: NTIS HC A03/MF A01

The most important methods described in literature for information transmission using adaptive delta modulation are surveyed. A method is proposed which combines the advantages of instantaneous value and syllable companded methods and works at a maximum transmission rate of 16 kbit/s, for a minimum CCITT signal to noise ratio and a sampling frequency of 32 kHz, and also if a suitable channel coding such as the Miller coding is selected. ESA

N77-20302# Ticra A/S, Lyngby (Denmark).
LOW GAIN S-BAND TT AND C ANTENNAS. DEVELOPMENT OF CARDIOID COVERAGE ANTENNA Final Report
N. C. Albertsen, P. Balling, F. R. Gregersen, and F. Laursen 12 Nov. 1976 212 p refs Prepared jointly with Dannebrog Elektronik A/S
(Contract ESTEC-2438/75-AK)
(S-44-02; ESA-CR(P)-891) Avail: NTIS HC A10/MF A01

Antenna designs are discussed for a cardioid shaped pattern providing sufficient coverage for the spacecraft telemetry/telecommand/ranging link. Two types of antenna are examined: wire-antenna array design and waveguide antenna design with conical reflector. The design of the hybrids utilized in feeding the antennas is described. Results for verification models of the waveguide antenna show that the mutual coupling between the probes of the antenna may cause a significant amount of azimuthal ripple. The wire antenna should theoretically give the required characteristics; however, its performance is degraded by the dielectric present in the antenna mounting. ESA

N77-20303# European Space Agency, Paris (France).
CARRIER AND CLOCK SYNCHRONISATION FOR TDMA DIGITAL COMMUNICATIONS
Floyd M. Gardner Dec. 1976 250 p refs
(ESA-TM-169-ESTEC) Avail: NTIS HC A11/MF A01

Studies performed for ESTEC on methods and problems of carrier and clock synchronization in a TDMA digital communications link are reported. The studies are part of a much larger series that are preliminary to a European telecommunications satellite system. Operation in the TDMA mode places unusual demands on synchronization circuits. Ordinarily, synchronizers for continuous-mode systems do not have requirements for fast acquisition of synchronism; some form of narrow-band, phase-locked loop is commonly used to establish local carrier and clock references at the receiver. TDMS operation is in a burst mode, however. In order to achieve good efficiency of communications, only a small portion of each burst can be devoted to synchronization. Fast synchronizing is essential if data capacity of the link is not to be wasted. A synchronization preamble no longer than 24 symbols is envisaged. Results of the study indicate that this goal is readily achievable, but not with conventional phase-lock methods. Author (ESA)

N77-20304# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
ERROR EQUATIONS USED IN THE NBS PRECISION G/T MEASUREMENT SYSTEM
W. C. Daywitt Sep. 1976 21 p refs Sponsored by Army
(PB-258331/8; NBSIR-76-842) Avail: NTIS HC A02/MF A01 CSCL 17B

Equations presently being used in the precision NBS G/T (system gain/system noise temperature) measurement system are presented. The assumptions upon which these equations are based and sample calculations showing how the measurement errors vary with antenna elevation angle are included. GRA

N77-20305# Federal Communications Commission, Washington, D.C. Spectrum Allocations Staff.
AN INVESTIGATION OF ECONOMIC FACTORS IN FCC SPECTRUM MANAGEMENT
John O. Robinson Aug. 1976 37 p refs
(PB-258500/8; FCC/OCE/SAS-76-01) Avail: NTIS HC A03/MF A01 CSCL 17B

The result of a preliminary analysis of the feasibility and merit of introducing market characteristics into the FCC spectrum management process are reported. The investigation is aimed at the more modest, but also the more practical, goal of introducing those economic techniques into spectrum management that will eventually result in some measure of increased efficiency in spectrum allocation and use. A free market in the spectrum is considered and rejected as not feasible at this time because of the cost of enforcing property rights. The investigation shows, however, that market characteristics applied within an administrative management process would result in more efficient allocation and use of the spectrum. Three techniques emerged as promising means by which to incorporate economic factors into administrative spectrum management. These include shadow pricing, user charges and auctions. GRA

N77-20306# National Weather Service, Silver Spring, Md. Office of Hydrology.
METEOR BURST COMMUNICATION SYSTEM: ALASKA WINTER FIELD TEST PROGRAM
Henry S. Santeford (Alaskan River Forecast Center) Mar. 1976 59 p refs
(PB-260449/4; NOAA-TM-NWS-HYDRO-30;
NOAA-76090804) Avail: NTIS HC A04/MF A01 CSCL 17B

The base station located in Anchorage received approximately 40,000 messages from the various remote units. The data were classified according to remote unit identification, date, time, and condition of the message. The detrimental effects of the aurora result in a multipath communication which scrambles the message;

such conditions were observed during approximately 11% of the hourly time periods. During aurora events, it took nearly 9 transmissions by the remote unit to get one good message through to the base station; during nonaurora periods it took less than 2 attempts to get one good message through to the base station. GRA

N77-20307# Federal Communications Commission, Washington, D.C. Research and Standards Div.

SATELLITE SYSTEM INTERFERENCE MODELING (11.7-12.2 GHz)

S. Das and George Sharp Sep. 1976 83 p refs

(PB-258737/6; FCC/OCE/RS76-04) Avail: NTIS HC A05/MF A01 CSCL 17B

The analysis and results are presented of a modeling technique to calculate the interference of a satellite network in the presence of other satellite networks. Five specific cases are reported: 81 satellites placed in (a) four homogeneous blocks, (b) seven homogeneous groups, (c) somewhat inhomogeneous groups (two cases), and 60 highly constrained or structured satellites. As the inhomogeneity increases, it becomes more difficult to obtain an optimum orbital separation between the satellites. GRA

N77-20308# Office of Telecommunications, Boulder, Colo.

TRANSMISSION CHANNEL CHARACTERIZATION BY IMPULSE RESPONSE MEASUREMENTS

R. F. Linfield, R. W. Hubbard, and L. E. Pratt Aug. 1976 61 p refs

(PB-258577/6; TR-76-96) Avail: NTIS HC A04/MF A01 CSCL 17B

Basic concepts, design criteria and hardware implementation are reviewed for measuring the impulse responses which characterize radio transmission channels. A channel sounder is described and was implemented for easy transport and operational convenience in collecting response data on a variety of transmission paths and over a wide frequency range. Some applications and measurement results are presented to illustrate the capabilities. GRA

N77-20309# Office of Telecommunications, Boulder, Colo.

ELECTROMAGNETIC COMPATIBILITY OF THE DEPARTMENT OF DEFENSE GROUND MOBILE FORCES TRANSPORTABLE EARTH TERMINALS WITH TERRESTRIAL SYSTEMS WITHIN THE 7.2-8.4 GHZ SPECTRUM

J. E. Adams, J. R. Juroshek, W. A. Kissick, and J. P. Murray Aug. 1976 163 p refs

(PB-258619/6; OTR-76-99) Avail: NTIS HC A08/MF A01 CSCL 17B

The small transportable earth terminal is examined. Electromagnetic compatibility of the small earth terminal (SET) with the terrestial microwave systems that share the 7.25 to 8.40 GHz band is studied. This is done by producing Restricted Area Maps (RAMs) for four specific areas of interest. Operation of an SET within the restricted regions on the RAMs result in interference to the terrestrial systems. In addition to the compatibility analysis, the applicability of the national and international radio regulations as they currently apply, or are interpreted to apply, to the SET are reviewed. The impact of the SET on the utilization of the geostationary orbit is examined. GRA

N77-20310# Mission Research Corp., Santa Barbara, Calif.

DEVELOPMENT AND TESTING OF DAVID: A CLOSE-IN EMP COUPLING CODE FOR ARBITRARILY SHAPED OBJECTS Topical Report, 1 Feb. - 1 Oct. 1975

Michael A. Messier, Robert M. Hamilton, and Kenneth S. Smith 7 Nov. 1975 236 p refs

(Contract DNA001-75-C-0094; DNA Proj. NWED-QAXEB088) (AD-A030684; MRC-R-228; DNA-3923T) Avail: NTIS HC A11/MF A01 CSCL 18/6

This report describes the development and testing of a 3-D, finite difference computer code used to estimate the currents and voltages induced on an arbitrarily shaped object when illuminated by a plane wave gamma source. The application of the code is for performing calculations to aid in the prediction of close-in EMP effects on systems. Included is a description of the way the physics of the problem is handled by the code, the methods used to obtain numerical solutions, the results of comparison tests and conclusions and recommendations. Author (GRA)

N77-20311# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.

ENDO ATMOSPHERIC-EXO ATMOSPHERIC RADAR MODELING MODEL DESCRIPTION, VOLUME 1, PART 1 Final Technical Report

Robert J. Hancock and Fred H. Cleveland Griffiss AFB, N. Y. RADC Jun. 1976 197 p refs

(Contract F30602-73-C-0380; AF Proj. 6512)

(AD-A030555; RADC-TR-76-186-Vol-1-Pt-1) Avail: NTIS HC A09/MF A01 CSCL 17/9

This effort is concerned with the development and implementation of a set of digital computer programs that will augment the RADC digital computer radar simulation model procured under Contr F30602-72-C-0393 (0170 7201). The computer programs shall consist of a sequence of subroutines that correspond to separate functions such as a chaff model, target model, propagation effects and clutter model. The original radar simulation model will be expanded to include a bistatic capability and will include ECM and phase coded pulse compression receiver techniques. In addition, an interactive system has been designed for the simulation. Using an interactive display, an engineer would be able to understand what is happening by being able to observe results at several intermediate points in the problem. A picture is worth a thousand words. For example, an antenna pattern or waveform response to a target is more meaningful than a long table of numerical listings. Parts of the simulation were used by RADC for Deep Space Surveillance Radar (DSSR) waveform analysis, generating antenna patterns and tradeoffs involving phase shifter bit-size for the Advanced Space Defense Program (ASDP). The RADC radar simulation model is being used to support Seek Sail, Cobra Judy, Digital Coded Radar and Seek Sentry. Author (GRA)

N77-20312# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.

ENDO ATMOSPHERIC-EXO ATMOSPHERIC RADAR MODELING TSAR/FSAR MODELING, VOLUME 3 Final Technical Report

Robert J. Hancock and Fred H. Cleveland Griffiss AFB, N. Y. RADC Jun. 1976 257 p refs 4 Vol.

(Contract F30602-73-C-0380; AF Proj. 6512)

(AD-A030572; RADC-TR-76-186-Vol-3) Avail: NTIS HC A12/MF A01 CSCL 17/9

This volume describes the integration of time scanned array radar (TSAR) and frequency scanned array radar (FSAR) system simulations into the Radar System Simulation Model (RADSIM). Section 2 discusses the theoretical concepts behind TSAR and FSAR techniques. It begins with the basic theory of phased arrays and array beam steering, and develops from these basic concepts the theory of TSAR and its associated beam steering. Finally, a discussion of the TSAR subsystems - the control generator, the interleaved array, the feed network and the search and track computer - is also included. Digital simulation of TSAR and FSAR subsystems through use of special TSAR and FSAR modules and basic RADSIM modules is discussed in Section 3. The documentation of specialized TSAR and FSAR modules is included and follows the same format as that of Volume II.GRA

N77-20313# Ohio State Univ., Columbus. ElectroScience Lab.

AN INTEGRAL EQUATION APPROACH TO OBTAIN THE SIGNIFICANT PARAMETERS OF DIHEDRAL CORRUGATED HORNS Final Report, 15 Sep. 1973 - 29 Feb. 1976

A. J. Terzuoli, Jr., C. W. Chuang, and L. Peters Jul. 1976 135 p refs

(Grant NSF GK-40489)

(PB-258489/4; ESL-3821-2) Avail: NTIS HC A07/MF A01 CSCL 09E

Moment method solutions are used to obtain design parameters for dihedral corrugated horns. Parameters of interest include the horn-waveguide junction, horn length, the corrugation depth, width and density. Particular attention is focussed on the dependence of the VSWR and the current density on the horn walls as these parameters are varied. One of the goals of the research (which was achieved) consisted of designing a corrugated

horn with an exceptionally low VSWR. A moment method solution is also given for a conical corrugated horn. This solution has not yet, however, been used extensively at this time. GRA

N77-20314# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
MEASUREMENTS OF DIGITAL SYSTEMS IN GAUSSIAN ADDITIVE NOISE AND INTERFERENCE
John R. Juroshek and Gene E. Wasson Sep. 1976 67 p refs
(PB-259240/0; OTR-76-104) Avail: NTIS HC A04/MF A01 CSCL 17B

A series of experimental measurements are described that examine the performance of the five different digital modems in Gaussian noise and additive interference. These experimental results are then compared with theoretical predictions to determine if the performance of digital systems can be accurately predicted. Some of the modems tested are: frequency-shift keying, phase-shift keying with coherent detection, and differentially encoded phase-shift keying with coherent detection. Also tested are two modems that use bandwidth conservation types of modulation. One of the bandwidth conservation modems uses minimum-shift keying as its basic modulation format. Test results are presented showing the results of interference from both unmodulated, continuous wave interference and modulated interference. GRA

N77-20315# Federal Communications Commission, Washington, D.C.
CHRONOLOGY OF THE NATIONAL SPECTRUM MANAGEMENT PROGRAM
Diane King Aug. 1976 33 p refs
(PB-259621/1; FCC/OCE/SMTF-76/01) Avail: NTIS HC A03/MF A01 CSCL 17B

The Federal Communications Commission established the Spectrum Management Task Force (SMTF) in 1970 in response to the growing problem of spectrum congestion. Charged with the responsibility to develop decentralized spectrum management techniques, the SMTF focused initially on the Land Mobile Radio Services, wherein congestion was most severe. GRA

N77-20316# Office of Telecommunications, Annapolis, Md.
SPECTRUM RESOURCE ASSESSMENT IN THE 2.7 TO 2.9 GHz BAND. PHASE 2: MEASUREMENTS AND MODEL VALIDATION
Robert L. Hinkle, Robert M. Pratt, and Robert J. Matheson Aug. 1976 91 p refs
(PB-258511/5; OTR-76-97; REPT-1) HC A05/MF A01 CSCL 17I

The Office of Telecommunications undertook a detailed program to measure and analyze spectrum utilization in the 2.7 to 2.9 GHz band in the Los Angeles and San Francisco areas in support of an Office of Telecommunications Policy Spectrum Resource Assessment task. The measurement program consisted of on-site visits to compare predicted and actual PPI interference patterns, and utilization of the Radio Spectrum Measurement System (RSMS) van to validate the component models used in predicting radar-to-radar interference. GRA

N77-20317# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
PARAMETRIC COST ALTERNATIVES FOR LOCAL DIGITAL DISTRIBUTION SYSTEMS
Martin Nesenbergs and Robert F. Linfield Jul. 1976 224 p refs
(PB-258510/7; OTR-76-95) Avail: NTIS HC A01/MF A01 CSCL 17B

To meet the projected, 1980 to 1985, digital service requirements, the Local Digital Distribution System (LDDS) is defined with a broad range of services in mind. The specification of these services has impact on the whole system and its subsystems. The parametric scaling of components and their operational features follows from the service requirements. The coaxial cable networks, which appear adequate for typical LDDS installations, are used as baseline systems to formulate alternative system concepts. One selects economically reasonable alternatives. In this process, system cost emerges as the most decisive parameter. Costs are assessed on a general parametric level for different configurations, as well as for specific case studies of Ft. Huachuca and Ft. Monmouth. GRA

N77-20318# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
PREDICTING THE PERFORMANCE OF HIGH FREQUENCY SKY-WAVE TELECOMMUNICATION SYSTEMS (THE USE OF THE HFMUFES 4 PROGRAM)
George W. Haydon, Margo Leftin, and Rayner K. Rosich Sep. 1976 165 p refs
(PB-258556/0; OTR-76-102) Avail: NTIS HC A08/MF A01 CSCL 17B

A description is given of the input information required and the outputs available from the latest version of the OT/ITS high-frequency sky-wave system performance prediction program (HFMUFES 4). Input requirements and typical output formats are described including their application in the planning and operation of high frequency communication systems using sky waves. The report stresses the mechanics of using HFMUFES 4 or its output rather than the theoretical aspects of the prediction method. The report is directed primarily toward new users of HF sky-wave predictions. Planned improvements in the predictions, expected benefits from these improvements and progress toward these improvements are a part of the report. GRA

N77-20319# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
REPORT ON 1976 MILLIMETER-WAVE CONFERENCE
M. C. Thompson, R. H. Ott, and E. J. Violette Sep. 1976 12 p Proc. of The Use of Millimeter Waves for Communications, Boulder, Colo., 2-4 Mar. 1976
(PB-258576/8; OT-SP-76-11) Avail: NTIS HC A02/MF A01 CSCL 17B

The purpose of the meeting was to encourage an exchange of views on the use of the radio spectrum above 10 GHz for communications. GRA

N77-20320# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
DIGITAL TRANSMISSION EVALUATION PROJECT, PHASE 1 Final Evaluation Report, Oct. 1973 - Jul. 1976
John J. McDonnell, James A. Hamant, and Edward New 13 Sep. 1976 22 p refs
(AD-A030349; CCC-CED-76-DTEP-013) Avail: NTIS HC A02/MF A01 CSCL 17/2

The Final Evaluation Report summarizes the information derived from Phase I of the Digital Transmission Evaluation Project over the period of October 1973 to July 1976. The project purpose is to test and evaluate commercially developed equipment in the field of wideband digital communications. Tested items are discussed, their individual reports identified, and their impact on Phase II are presented. Test categories used in this evaluation were bit error rate vs. received signal level, carrier-to-interference, power spectra, active link, and special additional tests. Summary of results are presented for the Motorola AN/FRC-80(V)3 Radio System, Raytheon RDS-80 Radio System, Raytheon RDS-80G Radio System, VICOM 4000 Series Digital Multiplexer, Collins MW-518 QPSK Radio, Collins AN/FRC 162 Radio, and Avantek DR8A Radio System. Test techniques are discussed in detail. These techniques are bit error rate vs. received signal level, carrier-to-interference, power spectrum, and bit error rate statistics. Conclusions recommend items suitable for implementation in the DCS and identify items which require further study.
Author (GRA)

N77-20321# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NOTE ON CUMULANT EXPANSIONS IN RUMMLER PROCESSING OF RADAR RETURNS
Richard W. Davies and Nathan E. Lindgren 14 Jul. 1976 36 p refs
(Contract F19628-76-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A029883; TN-1976-8; ESD-TR-76-209) Avail: NTIS HC A03/MF A01 CSCL 17/9

General formulas for wake mean velocity and velocity spread in terms of the radar measured pulse pair correlation coefficient are developed and illustrated for several Doppler spectra, including two that are asymmetric. GRA

N77-20322# Defense Communications Engineering Center, Reston, Va.
OPTIMIZING LINK UTILIZATION FOR A MIXED MEDIA SYSTEM
M. J. Fischer Aug. 1976 31 p refs
(AD-A030338; TN-15-76) Avail: NTIS HC A03/MF A01 CSCL 17/2

The capability is developed for analyzing and optimizing the behavior of a link in a circuit-switched communications network with mixed transmission media. This is done by making a quantitative analysis of the mixed media problem in terms of link utilization. Author (GRA)

N77-20323# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CIRCULAR POLARIZATION SCATTERING COEFFICIENTS FOR THE BISTATIC SCATTERING OF ELECTROMAGNETIC WAVES FROM PERFECTLY CONDUCTING SPHERES
R. Alexander Ross and Gary N. Cohen 27 Jul. 1976 107 p refs
(Contract F19628-76-C-0002; AF Proj. 627A)
(AD-A030043; TN-1976-34; ESD-TR-76-217) Avail: NTIS HC A06/MF A01 CSCL 17/9

The scattering by a number of perfectly conducting spheres has been calculated as a function of bistatic angle for both principal circular polarizations. Normalized radar cross section and scattering phase are tabulated for body circumference in wavelengths equal to 1.0(1.0)10.0, 15.0(5.0)50.0 with bistatic angles 0.0(1.0)180.0 deg. Selected graphs precede the tables. Author (GRA)

N77-20324# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
HWL RADAR SYSTEM ANALYSIS Final Technical Report
F. R. Williamson, R. R. Sheppard, C. E. Summers, and E. K. Reedy Jan. 1976 56 p refs
(Contract N00014-75-C-0228)
(AD-A030277; GIT-A-1711-000-F) Avail: NTIS HC A04/MF A01 CSCL 17/9

Research is reported relating to the weapons-location problem as it relates to Marine Corps Hostile Weapons Locating (HWL) radar and lightweight mortar locator requirements. Several technical system problems are discussed, including a review of the HWL system mechanical design. A detailed description is also given of the EES computer modeling program (ballistic trajectory model and radar operational simulation) that was used in studying the proposed test shots for the upcoming field test of the Advanced Development Feasibility Demonstration Model of the HWL radar system. GRA

N77-20325# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Surveillance Branch.
ADAPTATION OF THE SPACETRACK RADAR SOI SIGNATURE TRANSMISSION SYSTEM TO OPTICAL SOI DATA Interim Report
John V. Lambert Mar. 1976 45 p refs
(AF Proj. 7660)
(AD-A029921; AFAL-TR-76-40) Avail: NTIS HC A03/MF A01 CSCL 17/8

The introduction of passive non-imaging optical sensors into the operational system of the NORAD Space Object Identification (SOI) Center, posed the problem of efficient and accurate transmission of standardized target signature data to the Central Space Defense Center (SC) at Ent AFB, Colo. A signature transmission system is described which is believed compatible with the procedures employed by SDC as of January 1976 for transmission of radar signatures from existing SPACETRACK sites. The system uses a base-26 number system utilizing alphabetic characters such that the two data points are conveyed in three alphabetic characters. Details are included on the header, data, and ephemeris lines of the optical SOI signature message, and on the software required to generate these portions message from the particular IBM 1800 data tape standard used at the AFAL Cloudcroft E/O Facility in New Mexico. Sufficient detail is given to allow adaptation to other standard data bases. The program described uses the USAF AUTODIN network for bulk transmission. GRA

N77-20326# Naval Research Lab., Washington, D.C. Plasma Physics Div.
A NONLINEAR MODEL FOR EQUATORIAL SPREAD F: IRREGULARITY AND SCINTILLATION CALCULATIONS
B. E. McDonald, S. L. Ossakow, and A. J. Scannapieco (Science Applications, Inc., McLean, Va.) Aug. 1976 14 p refs
(NRL Proj. A03-16)
(AD-A030223; NRL-MR-3348) Avail: NTIS HC A02/MF A01 CSCL 17/2

It is shown, that a simple nonlinear model based upon plasma equations of motion and a wave equation for radio propagation is capable of predicting plasma irregularities and scintillations at the equator. The irregularities develop from a linear convective instability on the bottom of the F layer. Depleted regions, or bubbles, form and rise nonlinearly through the F peak, disturbing the top of the F layer. The equations of motion are integrated numerically, and then the parabolic equation is solved for propagation of a 300 MHz wave through the plasma. It is assumed that a modest total electron content of 5 x 10 to the 16th Power M(-2). From the radio wave solution scintillation indices are extracted as a function of time. Approximately two hours after the instability starts, S4 reaches 0.48, and the log power variance reaches 3.1 dB. GRA

N77-20327# Massachusetts Inst. of Tech., Cambridge. Electronics Systems Lab.
LOAD SHARING IN A COMPUTER-COMMUNICATION NETWORK
Eberhard Frank Wunderlich Aug. 1976 129 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A032135; ESL-R-678) Avail: NTIS HC A07/MF A01 CSCL 09/2

This study investigates load sharing in a system of computers interconnected by a store and forward communication network. The problem is analyzed by modeling both computers and communication channels as queues and evaluating system performance on the basis of the steady state expected time to process computer jobs in the system. Upper and lower bounds on this performance criteria are developed and used to define regions of operation for a network using load sharing. Two techniques for load sharing are then presented. The first technique, called statistical load sharing, consists of sending a fraction of the jobs arriving at overloaded computers to underloaded computers by random sampling. This technique is analyzed by a network of queues model. It is shown that the general formulation of statistical load sharing is a nonlinear multicommodity flow problem which can be solved by an efficient computer algorithm. The improvement in system reliability due to the ability of load sharing to provide emergency backup in case of computer failure is also studied. The second technique for load sharing, a type of dynamic load sharing, makes job assignments to computers on the basis of the computers not busy at the time of assignment. This technique is analyzed by an approximation to the hypercube queueing model. Author (GRA)

N77-20328# Harry Diamond Labs., Adelphi, Md.
A MEASUREMENT TECHNIQUE FOR DETERMINING THE TIME-DOMAIN VOLTAGE RESPONSE OF UHF ANTENNAS TO EMP EXCITATION
Daniel H. Schaubert, Arthur R. Indoris, and Frederick G. Farrar Aug. 1976 40 p refs
(DA Proj. 1W1-62118-AH-75)
(AD-A031979; HDL-TR-1778) Avail: NTIS HC A03/MF A01 CSCL 20/14

A laboratory time-domain measurement technique is being developed that will provide research, development, testing, and evaluation laboratories with the capability to determine quickly and economically the transient response of VHF and UHF antennas. The procedure uses a transverse electromagnetic (TEM) horn radiator to illuminate the test antenna with a short pulse of electromagnetic energy. The transient voltage generated at the output of the antenna by this incident field is approximately the impulse response of the antenna and can be used to obtain the approximate response of the antenna to an arbitrary incident field. In some cases, especially where the response to a nuclear EMP is desired, it may be necessary to process the data in order to compensate for the nonideal waveform that illuminates the test antenna. Analysis of the test equipment indicates that

the sampling oscilloscope and x-y recorder used in the experiment provide an accurate means of obtaining data. The wide-bandwidth radiation properties and small physical size of the TEM horn antenna are well suited to laboratory measurements, and a wire model antenna could be designed for field tests.
Author (GRA)

N77-20329# IIT Research Inst., Chicago, Ill.
A JOINT ARMY/AIR FORCE INVESTIGATION OF REFLECTION COEFFICIENTS AT C AND Ku BANDS FOR VERTICAL, HORIZONTAL AND CIRCULAR SYSTEM POLARIZATIONS Final Report, Nov. 1975 - Feb. 1976
A. E. Brindley, L. C. Calhoun, and T. N. Patton Jul. 1976 159 p refs
(Contract F33615-76-C-3044)
(AD-A031403; AFFDL-TR-76-67) Avail: NTIS HC A08/MF A01 CSCL 20/14

This report describes an experimental effort to measure the reflection coefficients of typical airport structures at C-Band (5000 MHz) and Ku Band (15,000 MHz) for vertical (VP), horizontal (HP), and circular (CP) system polarizations. The choice of polarization is of vital concern in the implementation of microwave landing systems since it offers the designer an opportunity to minimize multipath reflections - the most critical factor limiting system performance. The measurements were made on buildings along the flight lines of Areas B and C at Wright-Patterson AFB, Ohio. It is shown for sixteen different combinations of frequency, grazing angle and reflecting surface that vertical polarization produced more severe specular reflections than either horizontal or circular radiation in every case. The HP measurements showed an advantage of at least 3 db over VP for 81% of the cases and in 88% of the cases the CP exhibited a similar advantage over VP.
GRA

N77-20330# Pomona Coll., Claremont, Calif.
REFLECTION OF ELECTROMAGNETIC RADIATION FROM THE OCEAN SURFACE Final Report, 1 Mar. 1972 - 29 Feb. 1976
Jack C. Miller 30 Oct. 1976 28 p refs
(Contract N00014-73-C-0304)
(AD-A031998) Avail: NTIS HC A03/MF A01 CSCL 20/14

A method for calculating the electromagnetic field scattered from a rough, perfectly conducting surface having two-dimensional variation is presented. The calculation proceeds in two steps: (1) calculation of the current distribution on the surface via integral equation techniques; and (2) calculation of the scattered fields using these currents as sources. Shadowing and multiple scattering effects are included.
Author (GRA)

N77-20331# Naval Electronics Lab. Center, San Diego, Calif.
TIME-DIVERSITY MODEM FOR TACTICAL HF TELETYPE CIRCUITS. ON-THE-AIR TESTS VERIFY THAT TIME DIVERSITY PROVIDED BY NELC FIVE-TONE MODEM SIGNIFICANTLY IMPROVES BER OF TACTICAL HF TTY LINK
G. B. Johnson and G. A. Clapp 27 Sep. 1976 22 p
(XF21222015)
(AD-A032392; NELC-TR-2008) Avail: NTIS HC A02/MF A01 CSCL 09/5

A full-duplex FSK time-diversity modem using five tones was constructed in a unit requiring only 5.5 inches of rack space. HF tests over a 750-km circuit showed that the time-diversity modem has error rates 100 times lower than those of a URA-17C modem for 70% of the test period. For 90% of the test time the time-diversity modem had a measured bit error rate at least 10 times better than those of the URA-17C. Greatest improvement occurred when the circuit was experiencing large fades.
Author (GRA)

N77-20332# Auburn Univ., Ala. Engineering Experiment Station.
REAL-TIME PHASED ARRAY RADAR STUDIES Final Report
E. R. Graf and H. T. Nagle, Jr. 1976 430 p refs
(Contract DAAH01-71-C-1303)
(AD-A032121) Avail: NTIS HC A19/MF A01 CSCL 17/9

This final report describes components of a real-time Radar Operating System (RADACS) for an SEL86 computer controlled cross-bow phased array radar set. The report is composed of 5 separate parts, each describing a portion of the contract performance.
Author (GRA)

N77-20333# General Electric Co., Syracuse, N.Y. Heavy Military Electronic Systems.
FREQUENCY SCAN/SIGNAL PROCESSING STUDY Final Technical Report, 11 Feb. 1975 - 11 Jan. 1976
D. L. Binsley, E. W. Heinzerling, R. R. Kinsey, J. G. Reddeck, and T. B. Shields Aug. 1976 166 p refs
(Contract F30602-75-C-0099; AF Proj. 6512)
(AD-A032029; RADC-TR-76-120) Avail: NTIS HC A08/MF A01 CSCL 17/9

A comprehensive study has been made of array feed networks for frequency-phase scanned arrays and signal processing techniques and configurations suitable for processing time scanned array radar (TSAR) signals or frequency scanned array radar (FSAP) signals. A study of system requirements for the mission of deep space surveillance and space object tracking was made to provide guidance for the feed and signal processing studies and to provide the basis for performance comparisons between the various techniques. An assessment was made of the electromagnetic capability of the radar configurations as defined by MIL-STD-469 and the Office of Telecommunication's Policy (OTP) Manual of Regulations and Procedures for Radio Frequency Management.
GRA

N77-20334# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
RADIATION GENERATION FROM EXPLODING WIRE Final Report
M. G. Bhattacharya, J. P. Craig, and T. F. Trost 31 Aug. 1976 37 p refs
(Grant AF-AFOSR-2830-75; AF Proj. 9751)
(AD-A031007; AFOSR-76-1105TR) Avail: NTIS HC A03/MF A01 CSCL 19/1

A theoretical investigation has been performed on the dual nature of the experimentally observed X-ray spectra emitted by high power exploded wire plasmas. The observed spectra consist of a steeply decreasing region for photon energies below about 8KeV followed by a nearly constant region above this value. The region of steep decrease is the result of Bremsstrahlung from plasma electrons having a Maxwellian distribution. The constant region was considered as being caused by non-thermal high energy electrons. The constant region was investigated in more detail. They calculated first the Bremsstrahlung spectrum that would result from mono-energetic electrons of 5, 10, 20, 50 and 100 KeV incident on tungsten targets. All the spectra were found to have the same flat shape. The case of non-Maxwellian distribution of electrons was examined by using a distribution function appropriate to a homogeneous plasma in a strong electric field. After integration it was found that the spectrum changed from steep to flat as a function of time. It was concluded that a flat spectrum may arise through a distortion of the electron distribution function in a strong electric field.
Author (GRA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-20335*# Sprague Electric Co., North Adams, Mass.
DESIGN, DEVELOPMENT, MANUFACTURE AND QUALIFICATION OF WET-SLUG ALL-TANTALUM CAPACITORS Final Report, 27 Jul. 1973 - 15 Dec. 1976
Robert H. Maher 15 Jan. 1977 93 p
(Contract NAS8-29819)
(NASA-CR-150212) Avail: NTIS HC A05/MF A01 CSCL 09A

Specifications and qualification tests data are presented for

over eleven hundred T3 case all-tantalum capacitors encompassing four ratings. The finalized product has all the advantages of the silver cased wet and is capable of withstanding some reverse potential ac ripple current. Author

N77-20336*# Ohio Univ., Athens. Avionics Engineering Center.
ANALYSIS OF A FIRST ORDER PHASE LOCKED LOOP IN THE PRESENCE OF GAUSSIAN NOISE
Paul R. Blasche Mar. 1977 14 p refs
(Grant NGR-36-009-017)
(NASA-CR-152625; TM-46) Avail: NTIS HC A02/MF A01 CSCL 09C

A first-order digital phase locked loop is analyzed by application of a Markov chain model. Steady state loop error probabilities, phase standard deviation, and mean loop transient times are determined for various input signal to noise ratios. Results for direct loop simulation are presented for comparison. Author

N77-20337# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
HIGH POWER MICROWAVE TUBE RELIABILITY STUDY Final Report, May 1974 - Jul. 1975
Robert P. Zimmer, Frank E. Gramling, Frank H. Vogler, and Harrison M. Wadsworth Aug. 1976 229 p refs
(Contracts DOT-FA72WAI-241; F30603-74-C-0229; Proj. A-1532)
(AD-A033612/3; FAA-RD-76-172; RADC-TR-76-256) Avail: NTIS HC A11/MF A01 CSCL 09/1

Reliability performance models are presented for both individual and general classes of microwave tube types. The frequency range of the tubes if 400 MHz through 16 GHz, and the peak output power is generally over 100 watts. A method is developed for determining tubes requiring reliability improvement based expenditures required to replace failured tubes. Author

N77-20338# Rome Air Development Center, Griffiss AFB, N.Y.
AN EVALUATION OF EMITTER FOLLOWER LOGIC Final Report, Sep. 1975 - Sep. 1976
Henry Domingos and Peter M. Capani Sep. 1976 71 p refs
(Contract DOT-FA72WAI-241)
(AD-A033320/3; FAA-RD-76-180) Avail: NTIS HC A04/MF A01 CSCL 09/5

Emitter follower logic is a nonsaturating logic family with medium speed capabilities. When manufactured by a modernized planar nonepitaxial bipolar process, consistently high yields with low defect densities are realized along with comparatively high device packing densities. The economical manufacturing technology coupled with the simplicity of emitter follower logic, provides a cost-effective means of approach to large scale and very large scale integrated circuit production. The logic family is described and a history of the modernized planar process, descriptions and characteristics of emitter follower logic produced by this process, and some examples of LSI and VLSi circuits are included. Author

N77-20339# Georgia Inst. of Tech., Atlanta.
VOR VACUUM TUBE AVAILABILITY ASSESSMENT PROGRAM Final Report, 1 Jan. - 15 Aug. 1976
Gene K. Huddleston, Richard M. Cosel, and Warren D. Peele (Purdue Univ.) Oct. 1976 61 p refs Prepared in cooperation with Purdue Univ. and Florida Inst. of Technology Sponsored in part by RADC
(Contract DOT-FA72WAI-356)
(AD-A033645/3; FAA-RD-76-183) Avail: NTIS HC A04/MF A01 CSCL 09/1

The problem of the continued availability of vacuum tubes and solid state replacement devices to support representative VOR equipment through the 1980's is discussed. The reduced availability of vacuum tubes is due mainly to the massive transition to solid state equipment by the consumer entertainment industry. This action led to a large reduction of vacuum tube suppliers, and to a significant increase in the cost of vacuum tubes. Price and tube demand data are presented for selected VOR systems. The applicability of solid state replacement devices to the VOR equipments is discussed. Author

N77-20340# Rome Air Development Center, Griffiss AFB, N.Y.
AN EVALUATION OF CHARGED-COUPLE DEVICES TECHNOLOGY Final Report, Aug. 1975 - Sep. 1976
R. L. Anderson Oct. 1976 337 p refs
(Contract DOT-FA72WAI-241)
(AD-A034240/2; FAA-RD-76-198) Avail: NTIS HC A15/MF A01 CSCL 09/1

The principles of operation of charge coupled devices are presented and the variety of structural forms currently used are described along with processing methods. The capabilities and limitations of CCD's and their input and output circuits are discussed. The uses of CCD's as digital circuits, as analog circuits, and as image sensors are outlined. The report concludes with an overall evaluation of CCD technology. Author

N77-20341*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DIRECT CURRENT TRANSFORMER Patent Application
S. M. Khanna and Eugene W. Urban, inventors (to NASA) (NSF, Washington, D. C.) Filed 29 Mar. 1977 10 p
(NASA-Case-MFS-23659-1; US-Patent-Appl-SN-782462) Avail: NTIS HC A02/MF A01 CSCL 09A

A direct current transformer was built in which the primary consists of an elongated strip of superconductive material, across the ends of which is applied a direct current potential. Parallel and closely spaced to the primary is positioned a transformer secondary consisting of a thin strip of magnetoresistive material. NASA

N77-20342*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF FLAT CONDUCTOR CABLE FOR COMMERCIAL AND RESIDENTIAL WIRING
James R. Carden Washington Mar. 1977 20 p
(NASA-TN-D-8450; M-219) Avail: NTIS HC A02/MF A01 CSCL 09A

The overall spectrum of the space technology spin-off development project: development of Flat Conductor Cable (FCC) for commercial and residential wiring, is presented. A discussion of the background, program milestones, industry participants, system outgrowth, hardware availability, cost estimates, and overall status of the program is presented for the 1970-to-present time period. Author

N77-20343*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
MICROCOMPUTERIZED ELECTRIC FIELD METER DIAGNOSTIC AND CALIBRATION SYSTEM Patent Application
Larry D. Holley and Jerry W. Mason, inventors (to NASA) (Federal Electric Corp., Paramus, N. J.) Filed 24 Mar. 1977 14 p
(NASA-Case-KSC-11035-1; US-Patent-Appl-SN-780874) Avail: NTIS HC A02/MF A01 CSCL 09A

A method for rapid calibration of field meters used to measure electromagnetic field potential is described. A reference voltage is applied to the field meter for causing signals to be produced on the output terminals thereof. A bank of relays is provided for selectively connecting output terminals of the field meter to a multiplexer by means of a digital voltmeter and an oscilloscope. A frequency-shift-keyed receiver is also connected to one of the terminals of the field meter for transmitting and converting a frequency shift keyed signal to a digital signal which is, subsequently, applied to the multiplexer. A microprocessor generates coded command signals to the bank of relays and also to the multiplexer for controlling the comparison of the output signals with information stored within the microprocessor. NASA

N77-20344*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
A ROTARY ELECTRIC DEVICE Patent Application
Jesse Madey, inventor (to NASA) Filed 21 Mar. 1977 21 p
(NASA-Case-GSC-12138-1; US-Patent-Appl-SN-779871) Avail: NTIS HC A02/MF A01 CSCL 09A

An electric motor having an output shaft that rotates at a speed much slower than the speed of a commutation shaft comprises a stator having a cylindrical bore with a longitudinal axis and a rotor that carries the output shaft and rotates in the bore eccentrically about the axis so that there is contact and

no magnetic gap between a relatively small portion of the rotor periphery and the periphery of the bore. A magnetic field, rotating at the speed of the commutation shaft, is applied to the periphery of the bore. The field has longitudinally extending magnetic field components of opposite polarity so that around approximately 180 deg of the bore the field extends in a first direction, while around the other 180 deg of the bore the field extends in the opposite direction. The rotor includes permanent magnet pole faces at opposite ends of the bore. The pole faces of the rotor are alternately attracted to and repulsed from different portions of the periphery of the bore as the magnetic field rotates about the periphery of the bore. NASA

N77-20345# Bendix Corp., Kansas City, Mo.
PHOTORESIST APPLICATION BY ROLLER COATING
L. E. Schantz Aug. 1976 68 p ref
(Contract E(29-1)-613)
(BDX-613-1288) Avail: NTIS HC A04/MF A01

Roller coating of AZ1350J photoresist onto 3.75- by 4.5-inch (95 by 114 mm) substrates was investigated as an integral part of an overall, cost effective hybrid microcircuit (HMC) photolithography process. New equipment was needed to process multiple HMCs on a single substrate with sufficient parameter control to achieve the designed electrical characteristics. The roller coater study centered around the investigation and the control of those parameters which influence the dimensional quality of the thin-film, resistor-conductor pattern. General system operation, orientation to other processing equipment, and maintenance-facility considerations were also studied. The most important technical aspect of the photoresist coating is the thickness uniformity followed by the overall photoresist thickness. Three equipment variables: doctor bar pressure, roller/substrate interference, and roller thread configuration were found to control the overall resist thickness and thickness uniformity. ERA

N77-20346# Bendix Corp., Kansas City, Mo.
INTERCONNECTION TECHNOLOGY
W. P. Beck and J. R. Sim Aug. 1976 60 p refs
(Contract E(29-1)-613)
(BDX-613-1346) Avail: NTIS HC A04/MF A01

Techniques for application to present and future electronic assemblies are discussed. Topics include: (1) determination of the relative costs of welding opposed to the soldering of hybrid microcircuits (HMC) packages; (2) evaluation of the solderability of thin films including definition of solderability tests; (3) establishment of a thermocompression (TC) bonding schedule to attach gold plated copper leads to thin film gold conductors; (4) determination of relative assembly times for Ampere sockets and bifurcated terminals to interconnect ceramic substrates; (5) determination of a means of interconnecting stacked, open-faced substrates within tight packaging restraints and demonstrating its feasibility by fabricating a model; (6) evaluation of a flexible circuit to replace a problem printed circuit board for enhancement of visual inspection of solder joints; and (7) development of a process to reflow solder, in a single operation, all or half of the ribbon leads from an integrated circuit (IC) or HMC package to a printed circuit board (PCB). ERA

N77-20347# Bendix Corp., Kansas City, Mo.
SANDIA/BENDIX STANDARD PROCESS CAPABILITY STUDY OF PRINTED WIRING BOARDS
J. L. Wilson and C. W. Jennings (Sandia Labs., Albuquerque, N. Mex.) Aug. 1976 61 p
(Contract E(29-1)-613)
(BDX-613-1349) Avail: NTIS HC A04/MF A01

With the development of the SL/BX standard process for the manufacture of printed wiring boards, it was determined that a formal capability study should be undertaken. Ten lots of boards (252) were manufactured in the Bendix production department. One lot of boards (24) was manufactured in the Bendix Engineering Shop. Upon completion of inspection by Bendix, all boards were shipped to Sandia Albuquerque for further inspection and testing. Final inspection results of the 276 boards manufactured show the defects to be predominantly of a visual type. A total of 45 defective boards were found, for a 16 percent defective ratio. As a result of this study, the conclusion was reached that the Bendix production and Engineering Shop departments have the capability for producing printed wiring boards, within the requirements of the SL/BX standard process and related specifications. ERA

N77-20348# Bendix Corp., Kansas City, Mo.
COMPUTER AIDED FAILURE ANALYSIS
D. W. Clement Aug. 1976 21 p refs
(Contract E(29-1)-613)
(BDX-613-1369-Rev) Avail: NTIS HC A02/MF A01

A project is described to develop an automated failure analysis process which will reduce the costs and eliminate some of the problems associated with present trouble shooting procedures. A computer aided failure analysis (CAFA) system, which uses the computer equipment in the Data Acquisition System, was designed for use on this project. The system approach is to store a diagnostic analysis program in a centralized computer and activate the program through time share operation (TSO) terminals located in the manufacturing area. Automated fault isolation is accomplished by a question and answer communication between the computer and the troubleshooter. The computer asks questions about the test data and circuit performance to direct the troubleshooter to perform additional tests and checks. Ultimately, after guiding the troubleshooter through an analysis channel, the diagnostic program will decide on possible causes of failure. All statements and questions are presented to the user in English and all questions can be answered simply by typing a number into the TSO terminal. ERA

N77-20349# Bendix Corp., Kansas City, Mo.
MEMORY ASSEMBLY TO HYBRID MICROCIRCUITS Final Report
W. J. Kirk Aug. 1976 17 p ref Revised
(Contract E(29-1)-613)
(BDX-613-1371-Rev) Avail: NTIS HC A02/MF A01

A process is described for bonding and soldering a wired array of ferrite cores to a hybrid micro circuit (HMC). Well tinned magnet wires are produced and a programmed soldering machine is used to make repeatable solder joints. Memory planes are bonded to HMC's with an epoxy sheet adhesive. A thin polyurethane coating is applied to solder joints with a fine artist's brush under microscopes. A method of testing the memory plane on existing equipment and a cause of failure matrix for the completed module were developed. ERA

N77-20350# Bendix Corp., Kansas City, Mo.
ULTRASONICALLY WELDING ELECTRIC TERMINALS
G. S. Darner Aug. 1976 20 p refs Revised
(Contract E(29-1)-613)
(BDX-613-1376-Rev) Avail: NTIS HC A02/MF A01

Cleaning, surface finish, and plating were evaluated to determine their effects on ultrasonic weldability. The external application of heat was studied to observe any improvement in material weldability. Capabilities were established for welding two circuit layers separated by Mylar insulation and for terminating aluminum conductors to connector hardware. ERA

N77-20351# Bendix Corp., Kansas City, Mo.
EQUIPMENT EVALUATIONS AND PROCESS TECHNIQUES FOR DRAG SOLDERING PRINTED WIRING ASSEMBLIES Final Report
R. S. Morris Aug. 1976 45 p refs Revised
(Contract E(29-1)-613)
(BDX-613-1404-Rev) Avail: NTIS HC A03/MF A01

Equipment was evaluated and various techniques were investigated for applying automated drag soldering to printed wiring assemblies. The activity centered on the adaptability of the equipment and techniques to densely packaged, low quantity, and high reliability products. ERA

N77-20352# Bendix Corp., Kansas City, Mo.
INDUCTION SOLDERING EVALUATION
E. R. Friebe Aug. 1976 45 p
(Contract E(29-1)-613)
(BDX-613-1453) Avail: NTIS HC A03/MF A01

The temperature difference was measured across the RTV seal in the connector and the extent of seal damage from heat was determined. This investigation also determined the effects of subjecting the connector to a 600 F peak temperature. Seven work coils were evaluated and a coil was produced which makes

a consistently air tight solder joint while minimizing heat transfer to the connector seal. A process and induction heating coil were developed to solder EMR hardware to the adaptor ring while minimizing heat transfer to previously soldered terminations.ERA

N77-20353# Bendix Corp., Kansas City, Mo.
HYBRID MICROCIRCUIT INTRACONNECTION PROCESSES
A. O. Bendure Aug. 1976 84 p refs
(Contract E(29-1)-613)
(BDX-613-1257; PDO-6984719; PDO-6984743) Avail: NTIS HC A05/MF A01

Applique components were intraconnected with thermocompression bonds to chromium/gold metallized thin film networks. Critical processes, material parameters, quality criteria, and characterization techniques were evaluated. Thermocompression bonding was developed to provide intraconnections between the HMC gold conductor metallization and gold beam-lead active devices, gold plated external leads, and gold terminated applique devices, such as capacitors. An optimum combination of bonding parameters based on the fundamental physics of the process was developed. This philosophy required bonding equipment to be thoroughly characterized so that the value of bonding parameters (such as force and temperature) indicated on the bonder could be translated into measurable values of the force and temperature within the bond zone. ERA

N77-20354# Bendix Corp., Kansas City, Mo.
ACCURACY OF WEIGHT METHOD USED TO DETERMINE ALUMINUM FOIL THICKNESS
M. C. Lippert Aug. 1976 21 p
(Contract E(29-1)-613)
(BDX-613-1245-Rev; PDO-6984821) Avail: NTIS HC A02/MF A01

The performance of circuits produced by etching a pattern in thin aluminum foil bonded to a Mylar substrate depends on the uniformity of that aluminum foil. One method of determining this uniformity is to calculate the foil thickness from a specimen's weight and area. The errors resulting from limits on the accuracy of the reported density value, the weighing technique, and the technique of determining specimen area were investigated to evaluate the accuracy of this method. After these errors were determined, sample calculations were performed which showed how each of these expected errors affected the thickness value of the foil. Additional calculations were made to project the worst case combinations of these errors. ERA

N77-20355# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron and Plasma Physics.
CURRENT LIMITATION IN LOW PRESSURE MERCURY ARCS
S. Torven and M. Babic Jun. 1976 15 p refs Presented at the 4th Intern. Conf. on Gas Discharges, Swansea, UK, 1976
(TRITA-EPP-76-09) Avail: NTIS HC A02/MF A01

When the electric current in a low pressure arc with a long positive column is increased sufficiently, an electrostatic instability develops in the plasma which leads to formation of thin space charge layers across the column. The instability was investigated in a mercury plasma column kept axially homogeneous by a special technique. Values of some plasma parameters were measured at the instability threshold. It was found that the plasma is in a weakly ionized state in contrast to predictions by widely accepted current limitation theories. It was concluded that new types of theories are required to explain the observations.
Author (ESA)

N77-20356# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Elektroakustik.
CALCULATION OF THE FORCE ON A NON-NEUTRAL AND UNSYMMETRICALLY SUPPORTED PLANE CHARGE ELECTRET IN THE ELECTRET SLOT TRANSDUCER USING THE ENERGY PRINCIPLE [DIE BERECHNUNG DER KRAFT AUF EINEN NICHT-NEUTRALEN UND UNSYMMETRISCH GELAGERTEN FLAECHENLADUNGSELEKTRETEN IM ELEKTRET-SCHLITZWANDLER MIT HILFE DES ENERGIEPRINZIPS]
Guenter Morgenstern Apr. 1976 12 p ref In GERMAN
(IND-FB-86) Avail: NTIS HC A02/MF A01

The force calculation on a neutral electret symmetrically placed in an electret slot transducer is generalized to the case of non-neutral and unsymmetrical in relation to the plane charge electrets on the plates of a tandem capacitor. An expression is derived for the force on the electrets in x-direction as a function of capacitor voltages V1 and V2, the voltage V3 between the lower of the two capacitor plates, the geometric properties of the setup, the surface charge density, and the dielectric constant of the electret. ESA

N77-20357# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Elektroakustik.
CALCULATION OF THE FORCE ON A SPACE CHARGE ELECTRET IN THE ELECTRET SLOT TRANSDUCER [KRAFTBERECHNUNG AUF EINEN RAUMLADUNGS-ELEKTRETEN IM ELEKTRET-SCHLITZWANDLER]
Guenter Morgenstern Apr. 1976 9 p refs In GERMAN
(IND-FB-87) Avail: NTIS HC A02/MF A01

The energy principle is used to show that the force calculation of a space charge electret in an electret slot transducer can be replaced by the force calculation of a plane charge electret carrying the surface charges related to its space charge. ESA

N77-20358# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
ERROR ANALYSIS OF THE NONIDEAL RESISTANCE TRANSFORMATION [BERECHNUNG DES FEHLERS DER NICHT IDEALEN WIDERSTANDSTRANSFORMATION]
K.-H. Georgi Jun. 1976 25 p refs In GERMAN
(IND-FB-92) Avail: NTIS HC A02/MF A01

Mean value and scatter of the noise level were calculated for the case of Walsh transformation by a resistance matrix in an analog vocoder. The noise results from statistically distributed errors in the resistances. Statistical properties of the speech to be transformed were taken into account. ESA

N77-20359# Danish Research Center for Applied Electronics, Hoersholm.
THERMAL ASSESSMENT OF SILVER-CADMIUM BATTERIES FOR SPACE APPLICATION Final Report
A. Laursen and U. Fabricius Aug. 1976 156 p refs
(Contract ESTEC-2482/75-HP)
(ESA-CR(P)-887) Avail: NTIS HC A08/MF A01

A thermal study of silver-cadmium batteries for use onboard ISEE-B was made. A thermal model based on an equivalent electrical network was established which allows calculation of the dynamic power dissipation profile during discharge. A model of the ISEE-B battery was set up based on the model established. Calculated expected temperature profiles for the battery during specified environmental and electrical conditions were verified by tests. Good agreement was obtained between calculated and measured values. ESA

N77-20360# Siemens A.G., Munich (West Germany). Werk fuer Halbleiter.
EFFECTS OF TECHNOLOGICAL PARAMETERS ON THE OPTIMIZATION OF Si THYRISTORS' ELECTRICAL PROPERTIES Final Report
Fritz Kirschner Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 122 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-76-52) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 25.65

The effects of technological parameters on electrical properties were investigated and optimized for two special types of thyristors. The technological parameters of fast switching thyristors for the application in deflection-circuits of television sets and in electronic circuits of flashlight sets are the emitter geometry, the lateral conductance of the basis, the diffusion profile, the gold diffusion, and the surface concentration of the emitter dopant. The required electrical properties concern the turn-off time, firing current and voltage, break-over voltage, forward voltage, and the critical velocities of the increasing currents and voltages. The second device is a double-thyristor, a so-called triac. Besides the parameters already mentioned the base geometry and base width had to be optimized. Further electrical properties required are the firing currents in the four quadrants of the voltages and voltage commutation effects. Author (ESA)

N77-20361# AEG-Telefunken, Frankfurt am Main (West Germany).

NEW TECHNOLOGIES FOR SILICON POWER DEVICES. RECOMBINATION IN HIGHLY DOPED EMITTER REGIONS Final Report

Heinrich Schlangenotto, Helmut Maeder, and Joachim Dziewior Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 117 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.

(BMFT-FB-T-76-54) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 24.60

Lowering the recombination in emitter regions of p-s-n structures (thyristors) results in a reduction of the forward voltage drop for constant base lifetime or a reduction of the recovery time for constant voltage. The surge current capability is influenced strongly by the p emitter according to theory, whereas the n(+) region has small influence. Improved forward characteristics were obtained practically by introducing an additional steep doping gradient in p emitters with a deep low-gradient diffusion profile. The recombination parameters of alloyed, diffused and epitaxial emitter regions were determined. Comparing these results with measurements of the volume recombination using electron beam excitation leads to the conclusion that the emitter efficiency is mainly determined by a recombination layer at the p-n junction. Essential improvements can be expected from strain compensating doping. Author (ESA)

N77-20362# Thomson-CSF, Boulogne-Billancourt (France). Div. Tubes Electroniques.

STUDY OF A CARCINOTRON OSCILLATOR IN THE FAR-INFRARED RANGE Final Report

G. Kantorowicz and P. Palluel Nov. 1976 81 p Partly in ENGLISH and partly in FRENCH

(Contract ESTEC-2516/75-AK)

(RT-1737-T; ESA-CR(P)-894) Avail: NTIS HC A05/MF A01

The study of an extended bandwidth carcinotron delivering a minimum of 10 mW output power in a 20% bandwidth centered in the range 0.9 to 0.8 mm is presented. A carcinotron was manufactured and tested which has delivered more than 10 mW output power in the range 0.95 to 0.75 mm, with a power consumption less than 100 W. Author (ESA)

N77-20363# General Technology Systems Ltd., London (England).

DERATING AND RELIABILITY MODELS AND APPLICATIONS OF ELECTRICAL AND ELECTRONIC COMPONENTS FOR ESA SPACECRAFT Final Report

G. E. Hall, comp. Dec. 1976 423 p refs

(Contract ESA-2469/75-HP)

(GT-750543; ESA-CR(P)-890) Avail: NTIS HC A18/MF A01

The models are presented for electronic parts to be used in current and projected ESA spacecraft. These models are used to restructure ESA product assurance specifications and to merge existing specifications on derating requirements and failure rates. For each component, the rationals for derating/applications recommendation are related to the derating/applications specification. The reliability models analysis comprises a matrix identifying changes from previous specifications and a set of reliability model sheets for each part type examined. Proposals for merging specifications on derating and reliability models are presented, concisely demonstrating the advantages of a single parts usage document. A literature survey is given of parts applications, parts technology, reliability, and radiation effects. ESA

N77-20364# Colorado State Univ., Fort Collins. Dept. of Chemistry.

PULSED VOLTAMETRIC STRIPPING AT THE THIN FILM MERCURY ELECTRODE Interim Report

John A. Turner, Uri Eisner, and R. A. Osteryoung Oct. 1976 27 p refs

(Contract N00014-76-C-0092; NR Proj. 359-493)

(AD-A030407; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07/4

A computer controlled data acquisition system was used to generate comparative data for thin film anodic stripping voltammetry using staircase, differential pulse and square wave waveforms. Each waveform was tested for its sensitivity and speed of analysis. The square wave waveform was found to be the most sensitive, whether using the square wave or differential pulse measurements. This waveform offers the advantages of fast analysis time and discrimination against charging currents. Author (GRA)

N77-20365# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

THE DESIGN OF ALTERNATING LOGIC SYSTEMS WITH FAULT DETECTION CAPABILITIES M.S. Thesis

Dennis Andrew Reynolds Aug. 1976 150 p refs

(Contract DAAB07-72-C-0259)

(AD-A031429; UILU-ENG-76-2226; R-738) Avail: NTIS HC A07/MF A01 CSCL 09/2

The fault detection capability of a design technique named 'alternating logic design' is detailed. The technique achieves its fault detection capability utilizing a redundancy in time instead of the more conventional space redundancy and is based on the successive execution of a required function and its dual. In combinational networks the method involves the utilization of a self-dual function to represent the required function and the realization of the self-dual function in a network with structural properties which are sufficient to guarantee the detection of all single faults are derived. The application of alternating logic design to synchronous sequential machines is also studied, and a method for realizing any synchronous sequential machine with feedback and output circuitry designed using combinational alternating logic techniques is presented. The resulting realization is capable of detecting all single faults in the feedback and output combinational circuitry and all single input and output faults associated with the memory elements. Alternating logic design using alternating modules as basic design elements is also examined. Necessary conditions that a set of alternating modules be sufficient to construct alternating networks representing any arbitrary Boolean function are derived. Author (GRA)

N77-20366# Rome Air Development Center, Griffiss AFB, N.Y.

VARACTOR-TUNED HELICAL RESONATORS AT UHF

Uve H. W. Lammers and Martin R. Stiglitz May 1976 32 p refs

(AD-A031421; RADC-TR-76-138) Avail: NTIS HC A03/MF A01 CSCL 09/5

A JTIDS requirement calls for narrowing the front-end bandwidth of fast-tuning L-band receivers in order to improve their interference resistance. Filters suitable for this application have to be of high Q and compact design. Frequency tuning or switching within microseconds is required. The performance of optimally designed halfwave helical resonators is investigated with microwave varactors of Q greater than 4000 and Q greater than 10000 (at 50 MHz and 4V reverse bias) as tuning elements. Four filters were designed to cover sections of a frequency range 294 MHz to 1256 MHz. At the low end of this range the varactor Q is comparable to or better than that obtained from helical resonators of 1-in. shield diameter. At the high end of this range the varactor Q is such that there is a substantial degradation of overall resonator Q at maximum varactor capacitance (at 1V reverse bias). The compatibility of varactor-tuned helical filters with requirements of the JTIDS receivers is evaluated. Author (GRA)

N77-20367# BDM Corp., Albuquerque, N.Mex.

SCEPTRE/LOGIC CIRCUIT ANALYSIS PROGRAM USER'S MANUAL Final Report

Allan F. Malmbers and Larry D. Ray Jul. 1976 51 p

(Contract F29601-74-C-0106)

(AD-A031802; BDM/A-145-75-TR-R1; AFWL-TR-75-279) Avail: NTIS HC A04/MF A01 CSCL 09/2

SCEPTRE/LOGIC is a modified version of the SCEPTRE circuit analysis program. This manual is intended as a guide for SCEPTRE users who wish to utilize the LOGIC features of the modified code. It is written with the assumption that the reader is familiar with input preparation and application of SCEPTRE.GRA

N77-20368# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 May - 31 Jul. 1976

Melvin A. Herlin and Alan L. McWhorter 15 Aug. 1976 25 p

(Contract F19628-76-C-0002; AF Proj. 649L)

(AD-A032343; ESD-TR-76-227) Avail: NTIS HC

HC A02/MF A01 CSCL 09/2

Contents: Data systems -- (Digital computers -applications, integrated circuit processing, design and testing); Computer systems -- Solid state -- (Solid state device research, quantum electronics, materials research, microelectronics, surface-wave technology). GRA

N77-20369# Princeton Univ., N.J. Dept. of Electrical Engineering.

STUDY OF ELECTRONIC TRANSPORT AND TRAPPING IN TECHNOLOGICALLY IMPORTANT INSULATORS Final Report

Walter C. Johnson Apr. 1976 74 p refs

(Contract N00014-75-C-1074; DNA Proj. NWED-QAXTA007) (AD-A031332) Avail: NTIS HC A04/MF A01 CSCL 20/12

Studies of electron trapping in unannealed aluminum-implanted silicon-dioxide films show large concentrations of electron traps not present in control samples. A substantial fraction of the traps appear to be associated with displacement damage created by the implantation. A study of electron-beam-induced conduction in thermally grown silicon dioxide indicates that substantial concentrations of electron traps are generated through the oxide by bombardment with a nonpenetrating electron beam. This conclusion has been confirmed by investigation of the electron-trapping properties of oxides that had previously been subjected to nonpenetrating electron bombardment. A study of lateral nonuniformities and interface states in MIS structures has led to the development of three new methods for distinguishing between these two effects and to a new and simple method for determining the distribution of flatband voltages in a nonuniform MIS capacitor. Author (GRA)

N77-20370# Harry Diamond Labs., Adelphi, Md.

INVESTIGATION OF LONG-TERM STORAGE AND REVERSE LINK METHODS FOR THE 5-INCH SALGP DATA LINK

Telemachos Manolatos Aug. 1976 12 p Sponsored in part by Navy

(HDL Proj. 437644)

(AD-A031302; HDL-TM-76-20) Avail: NTIS HC A02/MF A01 CSCL 09/2

The 5-in. guided projectile must be programmed with certain flight data prior to launch. These data must be stored in the projectile for up to 5 min without power connections. Two methods of accomplishing this are discussed: (1) A nonvolatile metal nitride oxide silicon memory and (2) a complementary metal oxide semiconductor memory driven by energy stored on a capacitor. It is also desirable to check the accuracy of the message sent. A method of reading the message back by varying the impedance of the secondary coil is discussed. Author (GRA)

N77-20371# Naval Avionics Facility, Indianapolis, Ind.

STANDARD ELECTRONIC MODULES EXPLORATORY DEVELOPMENT MODULE PACKAGING STUDIES BY NAVAL WEAPON SUPPORT CENTER, CRANE AND NAVAL AVIONICS FACILITY, INDIANAPOLIS Summary Report, period ending FY 1976

B. Dale Tague 1 Sep. 1976 17 p refs

(AD-A031397; NAFI-TR-2148) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report summarizes the SEM Exploratory Development module packaging studies accomplished by NAFI and NWSC, Crane during FY 1976. The primary outputs of these studies are the criteria and background data to be used in the definition of a SEM conceptual module, or family of modules, compatible with higher level electronic functions. Author (GRA)

N77-20372# Little (Arthur D.), Inc., Cambridge, Mass.

ENERGY EFFICIENCY AND ELECTRIC MOTORS Final Report

Robert E. Hunt, Frank Seabury, and Philip F. Valence Aug. 1976 188 p refs

(Contract FEA-CO-04-50217-00)

(PB-259129/5; ADL-78537-FR; FEA/D-76/381) Avail: NTIS HC A09/MF A01 CSCL 09C

Areas of greatest energy conservation potential in electric motor use in the industrial and commercial sectors of the economy are identified along with the technological potential and economic trends that might influence the use of more efficient electric motors. It is reported that the 1- to 125-hp polyphase motors are the predominant energy consumers, accounting for about 26 percent of the total electric power generated in the U.S. Estimates of their potential for increased efficiency, coupled with possible replacement rates of lower to higher efficiency motors, indicate potential savings by 1990 of 35 billion kWh/year--or 60 million barrels of oil. GRA

N77-20373# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.

SENSITIVE ISOTROPIC ANTENNA WITH FIBER-OPTIC LINK TO A CONVENTIONAL RECEIVER Final Report, Apr. 1973 - Sep. 1974

E. B. Larsen, J. R. Andrews, and E. E. Baldwin Sep. 1976 114 p refs Sponsored in part by Army

(PB-258554/5; NBSIR-75-819) Avail: NTIS HC A06/MF A01 CSCL 09E

A broadband, active, isotropic receiving antenna was developed for the frequency range 15 kHz to 150 MHz. It was designed for use with a conventional receiver to measure weak, near-zone electric fields of unknown polarization, such as leakage emanations from electronic equipment placed within a shielded enclosure. The antenna system consists of three mutually-orthogonal active dipoles. The entire frequency range of each of the three field components is amplified and used to modulate a high-speed light emitting diode (LED) located inside the dipole. the modulated infrared (IR) signals are guided through glass fibers which connect the 'isolate' dipoles to avalanche photodiodes at the far end of the fiber guides. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-20374 Polish Academy of Sciences, Warsaw.

EXPERIMENTAL DETERMINATION OF COEFFICIENTS OF FILTRATION ALONG GROUPS OF FILAMENTS [DOSWIADCZALNE WYZNACZANIE WSPOLCZYNNIKOW FILTRACJIWZDLUZWIAZKI WLOKIEN]

W. Kalita and T. Kowalewski 25 Jun. 1976 16 p refs In POLISH

Copyright. Avail: Issuing Activity

Experimental studies of the filtration characteristics of porous mediums were conducted using theoretical models. The characteristics of flow along parallel cylindrical rods simulating filaments were emphasized. Results are presented and discussed. Author

N77-20375*# Grumman Aerospace Corp., Bethpage, N.Y.

ANALYSIS AND TESTS OF NASA COVERTED GROOVE HEAT PIPE Final Report

Cleveland, Ohio NASA Dec. 1976 55 p refs

(NASA Order C-65532)

(NASA-CR-135156) Avail: NTIS HC A04/MF A01 CSCL 20D

A low-cost thermal control heat pipe having nearly covered grooves extruded in aluminum was developed at NASA. Analytical predictions of transport capability are in excellent agreement with experimental results using ammonia. Axial heat transport predictions as a function of fluid charge are presented also for methane, ethane, propane, and butane. Experimental tests show performance considerably better than that of open groove extruded pipes and comparing favorably with that of more complicated arterial/wick configurations. For ammonia at 20 C, the covert groove pipe obtained a static wicking height of 2.5 cm and an axial heat transport capability of 143 W-m. Author

N77-20376*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL TESTS ON A 3-DIMENSIONAL FIXED-GEOMETRY SCRAMJET INLET AT M = 2.30 TO 4.60

J. N. Mueller, Carl A. Trexler, and Sue W. Souders Mar. 1977

178 p
(NASA-TM-X-73933) Avail: NTIS HC A09/MF A01 CSCL 20D

Wind-tunnel tests were conducted on a baseline scramjet inlet model having fixed geometry and swept leading edges at M = 2.30, 2.96, 3.95, and 4.60 in the Langley unitary plan wind tunnel. The unit Reynolds number of the tests was held constant at 6.56 million per meter (2 million per foot). The objectives of the tests were to establish inlet performance and starting characteristics in the lower Mach number range of operation (less than M = 5). Surface pressures obtained on the inlet components are presented, along with the results of the internal flow surveys made at the throat and capture stations of the inlet. Contour plots of the inlet-flow-field parameters such as Mach numbers, pressure recovery, flow capture, local static and total pressure ratios at the survey stations are shown for the test Mach numbers. Author

N77-20377*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
MEASUREMENTS OF THE REFLECTION FACTOR OF FLAT GROUND SURFACES Final Report
C. S. Ventres, M. M. Myles, and I. L. Ver Apr. 1977 47 p refs
(Contract NAS1-13814)
(NASA-CR-145138; BBN-3379) Avail: NTIS HC A03/MF A01 CSCL 20D

Measurements are made of the reflection factors of asphalt, concrete, and sod at oblique angles of incidence. Initial measurements were carried out in an anechoic chamber to eliminate the effects of wind and temperature gradients. These were followed by measurements made outdoors over a wider frequency range. Data are presented for the magnitudes of the reflection factors of asphalt, concrete, and sod at angles of incidence of 38 deg and 45 deg. Author

N77-20378*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
POWER CALCULATIONS FOR ISENTROPIC COMPRESSIONS OF CRYOGENIC NITROGEN
Jerry B. Adcock and Marilyn E. Ogburn Washington Mar. 1977 71 p refs
(NASA-TN-D-8389; L-11184) Avail: NTIS HC A04/MF A01 CSCL 20D

A theoretical analysis was made of the power required for isentropic compressions of cryogenic nitrogen in order to determine the extent to which the drive power for cryogenic tunnels might be affected by real-gas effects. The analysis covers temperatures from 80 to 310 K, pressures from 1.0 to 8.8 atm, and fan pressure ratios from 1.025 to 1.200. The power required to compress cryogenic nitrogen was found to be as much as 9.5 percent lower than that required to compress an ideal diatomic gas. Simple corrections to the ideal-gas values were found to give accurate estimates of the real-gas power values. Author

N77-20379*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMODYNAMIC PROPERTIES OF GASEOUS FLUOROCARBONS AND ISENTROPIC EQUILIBRIUM EXPANSIONS OF TWO BINARY MIXTURES OF FLUOROCARBONS AND ARGON
Noel A. Talcott, Jr. Washington Apr. 1977 111 p refs
(NASA-TN-D-8405; L-11274) Avail: NTIS HC A06/MF A01 CSCL 07D

Equations and computer code are given for the thermodynamic properties of gaseous fluorocarbons in chemical equilibrium. In addition, isentropic equilibrium expansions of two binary mixtures of fluorocarbons and argon are included. The computer code calculates the equilibrium thermodynamic properties and, in some cases, the transport properties for the following fluorocarbons: CCl2F, CCl2F2, CBrF3, CF4, CHCl2F, CHF3, CCL2F-CCl2F, CCLF2-CCIF2, CF3-CF3, and C4F8. Equilibrium thermodynamic properties are tabulated for six of the fluorocarbons(CCl3F, CCL2F2, CBrF3, CF4, CF3-CF3, and C4F8) and pressure-enthalpy diagrams are presented for CBrF3. Author

N77-20380*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A MODEL TO INVESTIGATE THE INFLUENCE OF SUSPENDED SEDIMENT ON THE MASS TRANSPORT OF A POLLUTANT IN OPEN CHANNEL FLOW M.S. Thesis - Old Dominion Univ.
Raymond Scott Chapman Mar. 1977 76 p refs
(NASA-TM-X-94601) Avail: NTIS HC A05/MF A01 CSCL 20D

An explicit two-dimensional finite difference model, designed to investigate the influence of suspended sediment on the pollutant transport process, is presented. Specific attention is directed toward examining the role of suspended sediment in: (1) the turbulent vertical transport mechanism in a stratified flow, and (2) pollutant uptake due to sorption. Results presented indicate that suspended sediment plays a major role in the pollutant transport process, and subsequently, any meaningful attempt to model the fate of a pollutant in an alluvial channel must account for the presence of a suspended sediment concentration profile. Similarly, the vertical and longitudinal pollutant concentration distributions provided by the model may be utilized to improve upon the predictive capacities of existing water quality models. Author

N77-20381# Chicago Univ., Ill.
[ELECTRONIC AND VIBRATIONAL EXCITATIONS OF DISORDERED, PARTIALLY ORDERED, AND ORDERED SOLIDS, LIQUIDS, AND GASES] Technical Progress Report, 1 Sep. 1975 - 31 Aug. 1976
1976 6 p refs
(Contract E(11-1)-2126)
(COO-2126-36) Avail: NTIS HC A02/MF A01

The electronic and vibrational excitations of disordered, partially ordered, and ordered solids, as well as related liquids and gases, were studied using Raman, Brillouin, and infrared spectroscopy, together with extrinsic perturbations such as temperature and uniaxial stress. ERA

N77-20382# Argonne National Lab., Ill.
EXPERIMENTAL AND ANALYTICAL STUDY OF THE SPUTTERING PHENOMENA
P. A. Howard Mar. 1976 100 p refs
(Contract W-31-109-eng-38)
(ANL-76-41) Avail: NTIS HC A05/MF A01

One form of the sputtering phenomena, the heat-transfer process that occurs when an initially hot vertical surface is cooled by a falling liquid film, was examined from a new experimental approach. Experimental evidence showed the sputtering front to correspond to a critical heat-flux (CHF) phenomenon. Data were obtained with water flow rates of 350-1600 lb/sub m/hr-ft and subcoolings of 40-140 F on a 3/8-in. solid copper rod at 1 atm. A two-dimensional analytical model was developed to describe a stationary sputtering front where the wet-dry interface corresponds to a CHF phenomena and the dry zone is adiabatic. Finally, by means of a coordinate transformation and additional simplifying assumptions, this analysis was extended to analyze moving sputtering fronts, and reasonably good agreement with reported data was shown. ERA

N77-20383# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
INDUSTRIAL THERMAL INSULATION: AN ASSESSMENT
R. G. Donnelly, V. J. Tennery, D. L. McElroy, T. G. Godfrey, and J. O. Kolb Aug. 1976 215 p refs Revised
(Contract W-7405-eng-26)
(TID-27120) Avail: NTIS HC A10/MF A01

Potential energy savings available through use of insulation in the various elements of the industrial sector, the status of insulation technology, e.g., materials, design economics, and thermal property testing and performance, and research and development targets within the insulation technology that will accelerate the effective use of insulation are among the topics discussed. Other major topics related to industrial thermal insulation considered include: (1) available insulation materials for cryogenic through high temperature applications; (2) energy conservation potential for insulation in various industrial applications; (3) economic considerations for application of insulation; (4) availability of thermal property data; and (5) thermal property testing and specification of insulation materials. ERA

N77-20384# Oak Ridge National Lab., Tenn.
EFFECTS OF EXPLOSION-GENERATED SHOCK WAVES IN DUCTS
M. R. Busby (Tenn. State Univ.), J. E. Kahn, and J. P. Belk 1976 11 p refs Presented at the 14th ERDA Air Cleaning Conf., Sun Valley, Idaho, 2 Aug. 1976 Sponsored in part by the US Nuclear Regulator Commission
(Contract W-7405-eng-26)
(CONF-760822-20) Avail: NTIS HC A02/MF A01

An explosion in a space causes an increase in temperature and pressure. To quantify the challenge that will be presented to essential components in a ventilation system, it is necessary to analyze the dynamics of a shock wave generated by an explosion, with attention directed to the propagation of such a wave in a duct. Using the equations of unsteady flow and shock tube theory, a theoretical model has been formulated to provide flow properties behind moving shock waves that have interacted with various changes in duct geometry. Empirical equations have been derived to calculate air pressure, temperature, Mach number, and velocity in a duct following an explosion. ERA

N77-20385# Utah Univ., Salt Lake City.
MODEL FOR TURBULENT DIFFUSION IN SHEAR FLOWS
S. K. Kao Jan. 1976 11 p refs Presented at Symp. on Atmospheric Turbulence, Diffusion, and Air Quality, Raleigh, N. C., 19 Oct. 1976
(Contract ET(11-1)-2455)
(COO-2455-9; Conf-761003-18) Avail: NTIS HC A02/MF A01

An analysis of the characteristics of the eddy diffusivity is made, and the equations for turbulent diffusion in shear flows are derived. It is shown that the coefficients of the eddy diffusion can be expressed in terms of a characteristic time, the velocity shear of the mean flow, and the variance of the intrinsic turbulent velocity. It is also shown that diffusion equations developed earlier become special cases of the present diffusion model for shear flows. ERA

N77-20386# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN INVESTIGATION OF IMPINGEMENT FORCES DUE TO WHEEL GENERATED SPRAYS Ph.D. Thesis
R. G. Lucas and D. J. Holness Jun. 1976 59 p refs
(BU-200) Avail: NTIS HC A04/MF A01

In order to compare methods of measuring the impingement force exerted by spray from a wheel, similar to that generated by an aircraft wheel traveling on a flooded runway, and to predict the loads exerted on deflectors designed to minimize damage due to impingement on aircraft structures, impingement forces due to wheel generated sprays were measured. A small sample spray was isolated from that produced by a solid model wheel, and direct force measurements were made by impinging all the sample on a plate rigidly attached to a strain gaged encastre beam. These measurements were compared with the forces calculated by the integration of spray pressures obtained from traverses with an intensity probe, in planes perpendicular to the direction of travel. Over the range 1 to 2.5 wheel diameters downstream of the wheel, plate force was found to be almost constant, whereas that obtained by the integration of the probe readings decreased in the downstream direction from being 30% less than that on the plate at one wheel diameter, to 45% less at 2.5 diameters. The effect of a variation in the angle between the probe axis and the spray direction on the calculated impingement force was investigated and found to be small. Author (ESA)

N77-20387# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Dept.
DETERMINATION OF GEOS FUEL LINE P-CLAMP CONDUCTION AND LINE INSULATION PROPERTIES
R. Hamann 4 Jan. 1975 7 p
(FOK-RV-75-18) Avail: NTIS HC A02/MF A01

The results of the hydrazine line P-clamp conduction test carried out according to GEOS test specifications TS G 5D11 are presented and evaluated. The test was carried out in the Fokker thermal vacuum facility. ESA

N77-20388# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SHOCK RECOMPRESSION OF A SUPERSONIC INTERNAL FLOW IN PRESENCE OF A BOUNDARY LAYER BLEED
Georges Meauze Nov. 1976 53 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-369)
(ONERA-NT-1976-8) Avail: NTIS HC A04/MF A01

An experimental setup, characterized by a great operational flexibility, was designed with a view to a better understanding of the functioning of the boundary layer bleed of an air intake with internal supersonic compression, and to knowing the influence of the various parameters on recompression efficiency and stability. To this end, the particular problem of the boundary layers bleed was dissociated from the general study of the supersonic air intake, by creating in a nozzle a flow with the Mach number reached at the end of internal recompression. All phenomena occurring before the bleed were thus eliminated. Various shapes of bleed were tested at Mach numbers 1.12, 1.42, and 1.72. The experiments made it possible to propose a simple theoretical model from which a calculation method was developed. This method permits an explanation and prediction of the experimental results with a good approximation, and the optimization, for a given incoming flow, of the bleed geometry. Author (ESA)

N77-20389# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
HANDBOOK OF GROOVED HEAT PIPES Final Report
Elfriede Hermann, Herbert Koch, Helmut Kreeb, and Michel Perdu Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 231 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-W-76-17) Avail: NTIS HC A11/MF A01; ZLDI, Munich DM 48,55

The handbook consists of materials data, a compilation of the computation procedures, and performance documents showing the effects of various parameters. The materials data contain the most important temperature-dependent and temperature-independent materials parameters of ordinary heat-transfer media, some wall-material data, and a compatibility matrix. The performance documents give the maximum powers for different parameters and operating conditions. They permit prior design of grooved heat pipes. Author (ESA)

N77-20390# Columbia Univ., New York. Lowell Memorial Library.
ETHYLENE OXIDE: STYRENE BLOCK COPOLYMER SURFACES FOR TURBULENT DRAG REDUCTION Final Report
Carl C. Gryte 31 Jul. 1976 106 p refs
(Grants NSF ENG-73-08197; NSF GK-37466)
(PB-258507/3; CCG-CU-76-08; Rept-00001) Avail: NTIS HC A06/MF A01 CSCL 20D

A drag reduction test facility was constructed to evaluate the effects of hydrophilic coatings on the turbulent friction factor for nylon tubes. A cobalt 60 gamma irradiation cell was reactivated. Procedures were developed to use this source to graft copolymerize acrylamide to nylon tubes. The synthesis of high molecular weight poly(ethylene oxide) block copolymers was attempted. The drag reduction characteristics of poly(acylamide), poly(acrylic acid), poly(ethylene oxide) and sodium alginate were measured in dilute aqueous solution. GRA

N77-20391# York Research Corp., Stamford, Conn.
ETI: ECONOMIC THICKNESS FOR INDUSTRIAL INSULATION Final Report
Washington, D. C. FEA Aug. 1976 202 p refs
(Contract FEA-CO-04-50169)
(PB-259937/1; FEA/P-75/712; FEA/D-CP-46) Avail: NTIS HC A10/MF A01 CSCL 13H

The conservation of energy through the use of optimal economic insulation thickness has obvious benefits for industry. The solution for economic thickness on both hot and cold systems is given. Since the insulation required to prevent condensate formation on cold systems may exceed the economic specification, a method for calculating the thickness required to prevent condensation has also been included. A procedure for calculating the economic thickness of insulation retrofitted in existing facilities

is presented, as well as example problems on the economic thickness determination. GRA

N77-20392# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

INLET VELOCITY DISTRIBUTION OF A FULL SCALE FLUSH INLET WATER JET

Revel S. Alder Aug. 1976 85 p ref
(ZF61412001)
(AD-A032261; SPD-718-01) Avail: NTIS HC A05/MF A01 CSCL 13/10

Full scale experiments at sea were conducted to evaluate the performance of two waterjet impellers and to determine the velocity distribution in the inlet of a typical waterjet. Inlet velocity and nozzle velocity measurements were made concurrently with full scale performance evaluation of a waterjet powered planing craft. Two impellers were evaluated in the experiments; one stock impeller, standard with the waterjet and one newly designed and constructed at the David W. Taylor Naval Ship Research and Development Center (DTNSRDC). Evaluation of both impellers was conducted for bollard and underway conditions. Velocity distributions for the underway conditions varied from zero velocity at the top of the duct to approximately 175% of craft velocity at the bottom of the duct. Bollard conditions were markedly different with the highest flow velocity occurring at the center of the duct. Experimental results indicate a need to improve the inlet design before potential improvement can be made in impeller design. The inlet performance could be improved by lengthening and smoothing out the duct or by redirecting the inlet flow with the use of vanes. Results of the impeller evaluations have been reported under separate cover. Author (GRA)

N77-20393# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

DETECTING STRUCTURAL HEAT LOSSES WITH MOBILE INFRARED THERMOGRAPHY. PART 4: ESTIMATING QUANTITATIVE HEAT LOSS AT DARTMOUTH COLLEGE, HANOVER, NEW HAMPSHIRE

R. H. Munis, S. J. Marshall, and M. A. Bush Sep. 1976 15 p
(AD-A031803; CRREL-76-33-Pt-4) Avail: NTIS HC A03/MF A01 CSCL 13/1

During the winter of 1973-74 a mobile infrared thermography system was used to survey campus buildings at Dartmouth College, Hanover, New Hampshire. This report provides both qualitative and quantitative data regarding heat flow through a small area of a wall of one brick dormitory building before and after installation of aluminum reflectors between radiators and the wall. These data were used to estimate annual cost savings for 22 buildings of similar construction having aluminum reflectors installed behind 1,100 radiators. The data were then compared with the actual savings which were calculated from condensate meter data. The discrepancy between estimated and actual annual cost savings is explained in detail along with all assumptions required for these calculations. Author (GRA)

N77-20394# Watervliet Arsenal, N.Y.

SOLUTIONS TO INITIAL VALUE PROBLEMS USING FINITE ELEMENTS. UNCONSTRAINED VARIATIONAL FORMULATIONS

J. J. Wu Sep. 1976 31 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A031410; WVT-TR-76038) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents a variational formulation which treats initial value problems and boundary problems in a unified manner. The basic ingredients of this theory are (1) adjoint variable and (2) unconstrained variations. It is an extension of the finite element-unconstrained variational formulation used previously in solving several nonconservative stability problems. The technique which makes this extension possible is described. This formulation thus enables one to adapt such numerical technique as the finite element method, which has had great success and popularity for solution of boundary value problems, for solutions of initial value problems as well. These formulations are given here for a forced vibration problem, a heat (mass) transfer problem and a wave propagation problem. Numerical calculations in conjunction with finite elements for two specific examples are obtained and compared with known exact solutions. GRA

N77-20395# Wisconsin Univ., Madison. Mathematics Research Center.

A SURVEY OF STEADY-STATE POROUS FLOW FREE BOUNDARY PROBLEMS Summary Report

Colvin W. Cryer Jul. 1976 141 p refs
(Contract DAAG29-75-C-0024; Grant NSF DCR-75-03838)
(AD-A031967; MRC-TSR-1657) Avail: NTIS HC A07/MF A01 CSCL 12/1

A comprehensive survey of steady-state, porous flow, free boundary (unconfined flow) problems is given. The problems are described and the numerical and analytical approaches which have been used are summarized. Attention is drawn to unsolved problems, and open questions. Author (GRA)

N77-20396# Naval Ship Research and Development Center, Bethesda, Md.

SIMILARITY-LAW ENTRAINMENT METHOD FOR THICK AXISYMMETRIC TURBULENT BOUNDARY LAYERS IN PRESSURE GRADIENTS

Paul S. Granville Dec. 1975 41 p refs
(ZR0230101)
(AD-A031168; DTNSRDC-4525) Avail: NTIS HC A03/MF A01 CSCL 20/4

Analytical relations have been derived for calculating developing thick, axisymmetric, turbulent boundary layer in a pressure gradient from two simultaneous differential equations: momentum and shape parameter. An entrainment method is used to obtain the shape parameter equation. Both equations incorporate the velocity similarity laws that provide a two-parameter velocity profile general enough to include any range of Reynolds numbers. Newly defined quadratic shape parameters which arise from the geometry of the thick axisymmetric boundary layer are analytically related to the two-dimensional shape parameter by means of these velocity similarity laws. The variation of momentum loss, boundary-layer thickness, local skin friction, and local velocity profile may be calculated for the axisymmetric turbulent boundary layers on underwater bodies, including the thick boundary layers on the tails. The various formulations are shown to correlate well with available experimental data. Author (GRA)

N77-20397# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

NONISOTHERMAL BAND MODEL THEORY Interim Report

Stephen J. Young 27 Sep. 1976 75 p refs
(Contract F04701-75-C-0076; DARPA Order 2843)
(AD-A031594; SAMSO-TR-76-207; TR-0076(6754-03)-2)
Avail: NTIS HC A04/MF A01 CSCL 07/4

Theoretical formulations of radiation band models for general nonuniform optical paths are presented. The models are framed within the statistical band model for an array of Lorentz lines and an inverse line strength distribution. Radiative transfer for an isolated line in a general nonuniform medium and the statistical model for a uniform optical path are reviewed in order to provide the foundation required for the band model formulations. Two approaches to the development of these models are taken. The first is based on making approximations to such radiative transfer functions as transmittance or equivalent width and yields models equivalent or similar to the traditional Curtis-Godson approximation. The second treats approximations to the spatial derivatives of these functions. From the standpoint of computing line or band radiance, the spatial derivatives are more fundamental quantities than the transfer functions themselves; consequently, these latter 'derivative approximations' are intrinsically more accurate than the Curtis-Godson type approximations. A summary of all of the models is given as a table of relevant equations for use in practical calculations. GRA

N77-20398# United Technologies Research Center, East Hartford, Conn.

A COORDINATE SYSTEM FOR A VISCOUS TRANSONIC CASCADE ANALYSIS Final Report, 12 May 1975 - 11 May 1976

Peter R. Eiseman 11 May 1976 56 p refs
(Contract N00019-75-C-0463)
(AD-A031209; UTRC/R76-912149-4) Avail: NTIS HC A04/MF A01 CSCL 20/4

A coordinate system suitable for the numerical computation of viscous transonic cascade flows is constructed. The general cascade problem is discussed, and solution of the Navier-Stokes equations is determined to be an effective method of analysis for this problem. The representation of cascade geometries is discussed, and the use of coordinate transformation is adopted. Many of the difficulties associated with previous geometric representations are overcome with the construction of a new coordinate system which is especially tailored to the numerical simulation of viscous flows through a cascade of airfoils. Large gradients in the viscous shear layers are adequately resolved with a simple coordinate distribution function along the outward normal direction from the airfoil. An essential ingredient in the generation of the cascade coordinates is the conversion of discrete curve-like data into analytically defined curves which accurately reflect the overall geometry. For this purpose a least squares spline procedure is employed. The coordinate generation procedure accepts discrete input data representing the airfoil surface, places little restriction on the airfoil camber or spacing and is easily extended to three dimensions. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-20399* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ALL SKY POINTING ATTITUDE CONTROL SYSTEM Patent

Kenneth R. Lorell and James P. Murphy, inventors (to NASA) Issued 15 Mar. 1977 11 p Filed 4 Oct. 1973 Supersedes N73-32784 (11 - 23, p 2851)

(NASA-Case-ARC-10716-1; US-Patent-4,012,018; US-Patent-Appl-SN-403695; US-Patent-Class-244-165; US-Patent-Class-235-150.2; US-Patent-Class-235-150.25; US-Patent-Class-244-3.21; US-Patent-Class-244-171) Avail: US Patent Office CSCL 14B

In a strapped-down gyroscope space vehicle attitude control system, a method and apparatus are provided for gyro drift and input axis misalignment error compensation employing a sun and a star tracker and preselected vehicle calibration maneuvers. The outputs of two-axis strapped-down gyroscopes nominally aligned with the optical axis of the sun and star trackers are measured to provide gyro drift calibration, roll, pitch and yaw axis scale factors and values corresponding to the degree of nonorthogonality between the roll axis and the pitch and yaw gyro input axes and the nonorthogonality of the roll and pitch axes relative to the yaw axis. The vehicle is then rolled and yawed through precomputed angles as modified by the calibrated data stored in a digital computer, and acquires a target without recourse to external references.

Official Gazette of the U.S. Patent Office

N77-20400* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

METALLIC HOT WIRE ANEMOMETER Patent

Fred R. Lemos, inventor (to NASA) Issued 15 Mar. 1977 6 p Filed 5 Sep. 1975 Supersedes N75-32426 (13 - 23, p 2918)

(NASA-Case-ARC-10911-1; US-Patent-4,011,756; US-Patent-Appl-SN-610802; US-Patent-Class-73-204; US-Patent-Class-338-28) Avail: US Patent Office CSCL 14B

A hot wire anemometer is described which has a body formed of heat resistant metal such as an alloy high in nickel content which supports a probe wire disposed in a V groove in the body. The V groove contains a high temperature ceramic adhesive that partially encompasses the downstream side of the probe wire. Mechanical and electrical connection to the probe wire is achieved through conductive support rods that are constructed of the same high temperature metal, insulation between the body and the conductor rods being provided by a coating of an oxide of the same material which coating is formed in situ. The oxide coating insulates the conductor rods from the body, mechanically fixes the conductors within the body, and maintains its integrity at elevated temperatures.

Official Gazette of the U.S. Patent Office

N77-20401* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MOUNT FOR CONTINUOUSLY ORIENTING A COLLECTOR DISH IN A SYSTEM ADAPTED TO PERFORM BOTH DIURNAL AND SEASONAL SOLAR TRACKING Patent

Lott W. Brantley and Billy D. Lawson, inventors (to NASA) Issued 15 Mar. 1977 5 p Filed 29 Jan. 1976 Supersedes N76-18679 (14 - 09, p 1153)

(NASA-Case-MFS-23267-1; US-Patent-4,011,854; US-Patent-Appl-SN-653422; US-Patent-Class-126-270; US-Patent-Class-126-271; US-Patent-Class-250-203R) Avail: US Patent Office CSCL 14B

A collector dish is continuously oriented toward the sun in a system adapted to perform both diurnal and seasonal solar tracking. The mount is characterized by a rigid, angulated axle having a linear midportion supporting a collector dish, and oppositely extended end portions normally related to the midportion of the axle and received in spaced journals. The longitudinal axis of symmetry for the midportion of the axle is coincident with a seasonal axis while the axes of the journals are coincident with a diurnal axis paralleling the earth's polar axis. Drive means are provided for periodically displacing the axle about the diurnal axis at a substantially constant rate, while other drive means are provided for periodically indexing the dish through 1 deg about the seasonal axis whereby the position of the dish relative to the axle is varied for accommodating seasonal tracking as changes in the angle of inclination of the polar axis occurs.

Official Gazette of the U.S. Patent Office

N77-20402*# National Aeronautics and Space Administration, Washington, D.C.

SPACE PHOTOGRAPHY 1977 INDEX

[1976] 199 p

(NASA-TM-X-74628) Avail: NTIS HC A09/MF A01 CSCL 14E

An index is provided to representative photographs and transparencies available from NASA. Subjects include spacecraft, astronauts, lunar surface, planets and outer space phenomena, earth observations, and aviation. High altitude aircraft infrared photographs are included along with artists' conceptions of space shuttle and space colonies. A.H.

N77-20403*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MINIATURIZED POINTING MOUNT PERFORMANCE ANALYSIS

George T. Howell, Jr. Nov. 1976 51 p refs

(NASA-TM-X-73374) Avail: NTIS HC A04/MF A01 CSCL 14B

Analytical analysis and computer simulation results of the miniaturized pointing mount as an instrument pointing system are presented. Miniaturized mount performance results include inertial pointing, slewing, tracking, and rastering. Typical instrument characteristics are used as well as some parameter variations of instrument and miniaturized pointing mount characteristics.

Author

N77-20404*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PACKAGING OF A LARGE CAPACITY MAGNETIC BUBBLE DOMAIN SPACECRAFT RECORDER

F. J. Becker and R. L. Stermer 14 Feb. 1977 7 p Presented at COMPCON, IEEE Spring Computer Conf., San Francisco, Mar. 1977 Prepared in cooperation with Rockwell Intern. Corp., Anaheim, Calif.

(NASA-TM-X-74170; X77-11/201) Avail: NTIS HC A02/MF A01 CSCL 14B

A Solid State Spacecraft Data Recorder (SSDR), based on bubble domain technology, having a storage capacity of 10 to the 8th power bits, was designed and is being tested. The recorder consists of two memory modules each having 32 cells, each

cell containing sixteen 100 kilobit serial bubble memory chips. The memory modules are interconnected to a Drive and Control Unit (DCU) module containing four microprocessors, 500 integrated circuits, a RAM core memory and two PROM's. The two memory modules and DCU are housed in individual machined aluminum frames, are stacked in brick fashion and through bolted to a base plate assembly which also houses the power supply. Author

N77-20405*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Physics and Geophysical Sciences.
A HIGH-TEMPERATURE WIDEBAND PRESSURE TRANSDUCER Final Report
Allan J. Zuckerwar Mar. 1977 106 p refs
(Grant NsG-1039)
(NASA-CR-149789; PGSTR-PH77-48) Avail: NTIS HC A06/MF A01 CSCL 14B

A condenser microphone AM carrier system, which has been developed to measure pressure fluctuations at elevated temperatures, consists of the following components: a condenser microphone designed for operation at elevated temperatures; existing carrier electronics developed under two previous research grants but adapted to meet present requirements; a 6 m cable operating as a half-wavelength transmission line between the microphone and carrier electronics; and a voltage-controlled oscillator used in a feedback loop for automatic tuning control. Both theoretical and practical aspects of the development program are considered. The three predominant effects of temperature changes are changes in the membrane-backplate gap, membrane tension, and air viscosity. The microphone is designed so that changes in gap and membrane tension tend to have compensating effects upon the microphone sensitivity. Author

N77-20406*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A UNIFIED ACQUISITION SYSTEM FOR ACOUSTIC DATA
Allan J. Zuckerwar (Old Dominion Univ, Norfolk, Va.) and Harlan K. Holmes Washington Mar. 1977 30 p refs
(NASA-TN-D-8327; L-10915) Avail: NTIS HC A03/MF A01 CSCL 14B

A multichannel, acoustic AM carrier system was developed for a wide variety of applications, particularly for aircraft noise and sonic boom measurements. Each data acquisition channel consists of a condenser microphone, an acoustic signal converter, and a Zero Drive amplifier, along with peripheral supporting equipment. A control network insures continuous optimal tuning of the converter and permits remote calibration of the condenser microphone. With a 12.70-mm (1/2-in.) condenser microphone, the converter/Zero Drive amplifier combination has a frequency response from 0 Hz to 20 kHz (-3 db), a dynamic range exceeding 70 db, and a minimum noise floor of 50 db ref. 20 micro Pa) in the band 22.4 Hz to 22.4 kHz. The system requires no external impedance matching networks and is insensitive to cable length, at least up to 900 m (3,000 ft). System gain varies only + or - 1 db over the temperature range 4 to 54 C (40 to 130 F). Adapters are available to accomodate 23.77-mm (1-in.) and 6.35-mm (1/4-in.) microphones and to provide 30-db attenuation. A field test to obtain the acoustical time history of a helicopter flyover proved successful. Author

N77-20407# National Aerospace Lab., Tokyo (Japan).
PROTOTYPE ROTARY-DRIVE VIBRATORY-OUTPUT RATE GYRO
Hiroshi Yamada Jul. 1976 16 p refs
(NAL-TR-463T) Avail: NTIS HC A02/MF A01

The results are presented of a study conducted on a rotary-drive vibratory-output rate gyro employed to provide damping as an attitude control component of a rocket and other applications. The rate gyro has the advantage of eliminating error due to rocket acceleration etc. The function and theory of operation of the rate gyro is explained along with the experimental results of the trial production rate gyro, which agreed well with the theoretical description. These results show the rate resolution based on a unity signal-to-noise ratio. Author

N77-20408*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLOW COMPENSATING PRESSURE REGULATOR Patent Application
Edward F. Baehr, inventor (to NASA) Filed 21 Mar. 1977 10 p
(NASA-Case-LEW-12718-1; US-Patent-Appl-SN-779428) Avail: NTIS HC A02/MF A01 CSCL 14B

An apparatus for regulating pressure of treatment fluid being supplied to a human or animal eye during ophthalmic procedures such as cataract surgery is disclosed. Flow sensing and pressure regulating diaphragms are provided in a body to modulate a flow control valve. The pressure regulating diaphragm is connected to the flow control valve to open the valve. The flow sensing diaphragm is mechanically connected to the flow control valve and opens it because of the differential pressure on the diaphragm generated by a flow of incoming treatment fluid through an orifice in the diaphragm. A bypass connection with a variable restriction is connected in parallel relationship to the orifice to provide for adjusting the sensitivity of the flow sensing diaphragm NASA

N77-20409*# Virginia Polytechnic Inst. and State Univ., Blacksburg. College of Engineering.
IMPLEMENTATION OF A STEREOFLUOROSCOPIC SYSTEM Final Report
D. B. Rivers 29 Oct. 1976 27 p refs
(Contract NAS9-14862)
(NASA-CR-151096) Avail: NTIS HC A03/MF A01 CSCL 14B

Clinical applications of a 3-D video imaging technique developed by NASA for observation and control of remote manipulators are discussed. Incorporation of this technique in a stereo fluoroscopic system provides reduced radiation dosage and greater vision and mobility of the user. A.R.H.

N77-20410*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
APPARATUS AND METHOD FOR DETERMINING THE POSITION OF A RADIANT ENERGY SOURCE Patent Application
Gustave J. Schaefer, inventor (to NASA) (Hughes Aircraft Co, Los Angeles) Filed 24 Mar. 1977 50 p Sponsored by NASA
(NASA-Case-GSC-12147-1; US-Patent-Appl-SN-780873) Avail: NTIS HC A03/MF A01 CSCL 14B

The position of a terrestrial RF source is determined from a geostationary, synchronous satellite by scanning the beam of a narrow beam width antenna in first and second orthogonal directions over a region including the source. The peak level of energy transduced by the antenna in each of the scanning directions is detected and correlated with the scanning position of the beam by feeding the output of a detector responsive to the transduced signal to an indicator of an X-Y recorder. The X and Y axes of the recorder are scanned in synchronism with the beam being respectively scanned in the first and second directions to form X and Y traces on which are indicated the detected peak position in each of the scanning directions. The source position is determined from an intersection of lines drawn parallel to the X and Y axes and including the detected peak position of each trace. NASA

N77-20411# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
HIGH RESOLUTION, NARROW BEAM ECHO SOUNDER Summary Report
E. D. Squier, R. B. Williams, S. P. Burke, and F. H. Fisher 1 Jun. 1976 22 p refs
(Contract N00014-69-A-0200-6002)
(AD-A030972; MPL-U-69/75; SIO-Ref-76-8) Avail: NTIS HC A02/MF A01 CSCL 17/7

This work describes the development of a high resolution echo sounder for use with the R/P FLIP. The instrument has a source level of - 227 dB/micro Pa, a 3 dB beam width of 1 deg and a receiver sensitivity of 176 dB/Micro Pa providing operating capabilities as a bottom sounder for water depths to 2,000 m. The results of its operation at sea along with observations of acoustic returns from multiple thin scattering layers to depth of over 400 m are included. Graphic examples under various

operating conditions are presented as well as reflection coefficients measured from bottom returns and acoustic scattering target strengths. Author (GRA)

N77-20412# California Univ., Livermore. Lawrence Livermore Lab.

CRYSTAL STREAK CAMERA

16 Jul. 1976 8 p refs Presented at 12th Intern. Congress on High Speed Photography, Toronto, 1 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-77739; Conf-760828-4) Avail: NTIS HC A02/MF A01

A high speed optical deflection system was designed for picosecond laser pulse diagnostics. Evaluation of a prototype system indicates that an ultracompact streak camera with picosecond resolution can be constructed. A commercially available electro-optic beam deflector with a 2-mm aperture ADP crystal is used in the prototype. This unit is capable of deflecting wavelengths from the visible to 1.06 microns. When high power single picosecond pulses are used, previous limitations of electro-optic deflectors due to single beam absorption, internal heating, and mechanical shock waves are overcome. At 532 nm, a resolution of 18 spot diameters is obtained, while the dynamic range in excess of 200 is limited by the readout system. Use of a crystal material with a much higher electro-optic coefficient produces a theoretical resolution comparable to that of electro-optic cameras. Readout is accomplished with film, a TV camera, or a linear diode array. ERA

N77-20413# Los Alamos Scientific Lab., N.Mex.

PULSED LASER STEREO PHOTOGRAPHY OF ELECTRICALLY EXPLODED BRIDGES

W. L. Seitz and S. D. Gardner 1976 8 p refs Presented at 20th Ann. SPIE Tech. Symp., San Diego, Calif., 23 Aug. 1976 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-76-1687; Conf-760832-10) Avail: NTIS HC A02/MF A01

A technique is described for obtaining short exposure (approximately 8 ns) high resolution photomicrographs of electrically exploded bridges using a pulsed laser for bridge illumination and band-pass filters to eliminate the intense self light. Two cameras are described, one for a small field of view (approximately 1 mm) and one for a relatively large field of view (approximately 20 mm). A carbon disulfide cell and a fiber-optic light guide are used to essentially eliminate speckle, which normally limits the resolution of laser photographs of diffuse surfaces. A series of photomicrographs showing the detailed burst characteristics of both flat and round bridges are shown. ERA

N77-20414# California Univ., Livermore. Lawrence Livermore Lab.

TIME RESOLVED X-RAY PINHOLE PHOTOGRAPHY OF COMPRESSED LASER FUSION TARGETS

D. T. Attwood 26 Jul. 1976 9 p refs Presented at 12th Intern. Congr. on High Speed Photography, Toronto, 1-7 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-77743; Conf-760828-8) Avail: NTIS HC A02/MF A01

Use of the Livermore X-ray streak camera to temporally record X-ray pinhole images of laser compressed targets is described. Use is made of specially fabricated composite X-ray pinholes which are near diffraction limited for 6 A X-rays, but easily aligned with a He-Ne laser of 6328 A wavelength. With a 6 micrometer X-ray pinhole, the overall system can be aligned to 5 micrometer accuracy and provides implosion characteristics with space-time resolutions of approximately 6 micrometer and 15 psec. Acceptable criteria for pinhole alignment, requisite X-ray flux, and filter characteristics are discussed. Implosion characteristics are presented from our present experiments with 68 micrometer diameter glass microshell targets and 0.45 terawatt, 70 psec Nd laser pulses. Final implosion velocities in excess of 3 x 10 to the 7th power cm/sec are evident. ERA

N77-20415# California Univ., Livermore. Lawrence Livermore Lab.

PICOSECOND X-RAY SPECTRAL STUDIES

D. T. Attwood and L. W. Coleman 21 Jul. 1976 8 p refs Presented at 12th Intern. Congr. on High Speed Photography, Toronto, 1 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-78422; Conf-760828-7) Avail: NTIS HC A02/MF A01

The use of the Livermore 15 psec X-ray streak camera to record X-ray emissions in the 1-10 keV range is described. In particular, significant progress is reported during the past year in defining the camera as a quantitative diagnostic instrument, and its implementation for multi-channel, time resolved K-edge filter measurements. Data are presented which describe X-ray emission from a laser imploded 87 micro m diameter glass shell. Channels centered at 2.6, 4.0, and 5.3 keV provide temporal information which is related to the absorption and compression phases of laser heating. The relative spectral content is found to be in agreement with standard, time integrated measurements. ERA

N77-20416# California Univ., Livermore. Lawrence Livermore Lab.

ULTRAVIOLET PROBING OF LASER PRODUCED PLASMAS WITH PICOSECOND PULSES

D. T. Attwood and L. W. Coleman 21 Jul. 1976 10 p refs Presented at 12th Intern. Congr. on High Speed Photography, Toronto, 1 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-77744; Conf-760828-6) Avail: NTIS HC A02/MF A01

The relationship between these plasma parameters and the requisite photographic system is described. It is concluded that the system requires a probe wavelength in the middle ultraviolet, a pulse duration in the 10 to 100 picosecond regime, and large numerical aperture optics corrected for spherical aberrations. Results obtained at 2660 A with holographic microinterferometry, Faraday rotation, and shadowgraphs are presented. ERA

N77-20417# Sandia Labs., Albuquerque, N.Mex. Systems Engineering Div.

HI-G ACCELERATOR SYSTEM

J. Paul Atencio Jul. 1976 76 p
(Contract E(29-1)-789)
(SAND-76-0161) Avail: NTIS HC A05/MF A01

The design criteria and operational capabilities of the Hi-g accelerator system, a pneumatically operated device are described. The system was designed to accelerate an experiment package up the experimental tube of the Sandia Annular Core Pulse Reactor. A variety of experimental sizes can be accommodated by the system and a wide range of acceleration levels is possible. ERA

N77-20418# Siemens-Werke, Berlin (Germany). Bereich Elektronemikroskope.

FUNDAMENTAL RESEARCH IN THE FIELD OF HIGH RESOLUTION SCANNING TRANSMISSION Final Report

Karl-Heinz Mueller and Burkhard Krisch Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1976 58 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-76-57) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 12.20

Basic research and development activities for a new high resolution scanning transmission electron microscope are described. The electron optical system consists of a 100 kV field emission gun, a high resolution objective lens with the ability of full specimen manipulation, the detector unit, and an energy analyzer. The microscope column is protected against mechanical vibrations. The vacuum system provides an ultra high vacuum nearly free of hydrocarbons. The complex electronics incorporate highly stable supplies, signal detection, and signal processing with large band width, CRTs, scanning generator and controls. Several complex technological problems had to be solved to construct the first prototype microscope. Examples demonstrate the application possibilities of this type of microscope. Author (ESA)

N77-20419# Physics Lab. RVO-TNO, The Hague (Netherlands).

DELTA V AMPLIFIER

A. Bruin Apr. 1976 39 p In DUTCH; ENGLISH summary
(Contract A71/KL/116)
(PHL-1976-16; TDCK-67781) Avail: NTIS HC A03/MF A01

An apparatus used as part of a measuring system for determining the velocity and deceleration of projectiles in flight is described. It consists of up to ten coils, connected in series, and the delta V amplifier. The signals, generated when a magnetized projectile passes near or through the coils, are converted to pulses by the delta V amplifier. These pulses are used as start and stop pulses for electronic counters. The pulses are distributed sequentially over up to 10 counters by means of a switching unit. When the coils are placed along the trajectory of the projectile at fixed distances, the counters present the times of flight between adjacent coils. With these time values the velocity and deceleration of the projectile can be calculated.
Author (ESA)

N77-20420# Aeronutronic Ford Corp., Newport Beach, Calif. Aeronutron Div.
AMBIENT CARBON MONOXIDE MONITOR Final Report
Darrell E. Burch, Francis J. Gates, and John D. Pembrook Jul. 1976 30 p refs
(Contract EPA-68-02-2219)
(PB-259577/5; U-6210; EPA-600/2-76-210) Avail: NTIS HC A03/MF A01 CSCL 14B

A portable instrument was designed and two units were built to monitor the concentration of CO in ambient air. The air flows through a sampling section that is approximately 43 cm long with a 28 pass optical system that produces a total path of 12 meters. Gas filter correlation methods are employed for the detection and discrimination against other gas species in the air. An H2O monitor built into the main instrument measures the concentration of H2O and automatically accounts for a small amount of interference by the gas. Interference by all other atmospheric gases is negligible. The minimum detectable concentration of CO is less than 0.02 ppm. The instrument is powered either by batteries or by a battery pack. GRA

N77-20421# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
NBS INTERAGENCY TRANSDUCER PROJECT Progress Report, 1 Jan. - 30 Jun. 1976
J. S. Hilten, C. F. Vezzetti, J. F. Mayo-Wells, and P. S. Lederer 1 Nov. 1976 25 p refs Sponsored in part by Naval Air Systems Command and Range Commanders Council
(PB-259243/4; NBSIR-76-1144; PR-5) Avail: NTIS HC A02/MF A01 CSCL 14B

Experimental efforts are described in the development and evaluation of means to reduce the effects produced by thermal radiant energy transients on pressure-transducer response. Both unbonded strain-gage and piezoelectric pressure transducers were used with protective coatings applied directly to the diaphragms. The test method employed is to expose a pair of transducers - one protected and the other unprotected, but otherwise nominally identical - to a known radiant energy transient with an energy density of approximately 20 mJ/sq/mm. The resulting zero shift is measured and taken as an index of coating effectiveness.
GRA

N77-20422# National Bureau of Standards, Washington, D.C. Optical Physics Div.
OPTICAL RADIATION MEASUREMENTS: DEVELOPMENT OF AN NBS REFERENCE SPECTROPHOTOMETER FOR DIFFUSE TRANSMITTANCE AND REFLECTANCE Final Report
William H. Venable, Jr., Jack J. Hsia, and Victor R. Weidner Oct. 1976 51 p refs
(PB-259640/1; NBS-TN-594-11) Avail: NTIS HC A04/MF A01 CSCL 14B

A reference spectrophotometer, designed primarily for the analysis of diffuse transmittance and reflectance, was developed. The spectrophotometer consists of a broad band monochromator with optical bandpasses of 2, 5, 10, and 20 nanometers. The exit aperture of the monochromator is provided with special mirror optics to collimate and switch the beam for optional use as a reference or sample beam. These collimated beams are directed into a dark room where a variety of sampled mounts, light gathering devices, and detectors can be installed. The design of the instrument is described in detail, and the results of the performance tests are given. Detailed error analyses which were carried out to date are also included. GRA

N77-20423# Texas A&M Univ., College Station. Ocean Engineering Program.
SUPPLEMENTAL LIGHTING FOR UNDERWATER PHOTOGRAPHY. A COMPUTER PROGRAM FOR DESIGN ANALYSIS
Bernard D. Greeson and Robert E. Randall Sep. 1976 86 p refs
(Grant NOAA-04-5-158-19)
(PB-260927/9; COE-194; TAMU-SG-76-212; NOAA-76092303) Avail: NTIS HC A05/MF A01 CSCL 14E

Mathematical expressions which can be used to analyze the design of an underwater lighting system, to introduce a computer program which can be used to solve these expressions by numerical techniques, and to illustrate the use of this program in the design of two hypothetical lighting arrangements are discussed. Mathematical expressions for the image contrast, spectral radiance, and overall brightness of the light received by the camera are developed. A computer program is described which numerically solves the mathematical equations for image contrast, spectral radiance, and over-all brightness for a particular lighting system. GRA

N77-20424# National Oceanographic Instrumentation Center, Washington, D.C.
TEST RESULTS ON AN ELECTROMAGNETIC CURRENT SENSOR WITH AN OPEN DESIGN
David R. Crump Aug. 1976 19 p refs
(PB-260444/5; NOAA-S/T-76-2212; NOAA-76083101; NOAA-TM-NOS-19) Avail: NTIS HC A02/MF A01 CSCL 08C

An electromagnetic current sensor with a unique 'open' design was tested for steady flow accuracy and cosine response in the horizontal and vertical planes. The sensor's configuration was designed to minimize hydrodynamic disturbances of the current flow and to offer good linearity and directivity response. Test data revealed the sensor's steady-flow measurement uncertainty to be + or -2.5 percent of full scale. Horizontal directivity errors were less than + or -4 cm/s and 5 cm/s for half-and one-knot test flows. The major contributor of error for the cosine response was determined to be an imbalance in amplifier gain between the sensor's two measuring axes. GRA

N77-20425# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Physical Sciences Directorate.
USE OF FOURIER ANALYZER FOR FAR-FIELD SPECKLE ANALYSIS
J. Lynn Smith 4 Aug. 1976 14 p refs
(DA Proj. 8X3-63304-D-215)
(AD-A031239; RR-7T-3) Avail: NTIS HC A02/MF A01 CSCL 20/6

A sequel to Surface Information From Far-Field Speckle Analysis (AD-A031239 report No. RR-TR-76-2) is presented. A clarification of how the theoretical results of that report relate to experimental data input for the HP 5451B Fourier analyzer is undertaken. The relationship between time, frequency, and position as well as the appropriate choice of data intervals are discussed. The rectangular window width is shown to be incorporated into a function defined in the previous work which determines resolution of surface detail. Author (GRA)

N77-20426# General Electric Co., Syracuse, N.Y. Optoelectronic Systems Operation.
DEVELOPMENT OF INDIUM ANTIMONIDE CID ARRAYS Final Report, Sep. 1974 - Sep. 1975
J. C. Kim Aug. 1976 98 p refs
(Contract N00014-75-C-0124; DARPA Order 2908; SF54583004)
(AD-A030022) Avail: NTIS HC A05/MF A01 CSCL 17/5

The successful development of InSb charge injection device (CID) arrays has been made possible by the recent success of our InSb MIS technology, which is now capable of producing two-dimensional InSb CID arrays. This Final Report describes the development of 1 x 16 two-dimensional InSb CID arrays.

The InSb wafer material preparation is described in Section 2. The improved interface state densities of InSb MIS structures are presented in Section 3. The sensitivity measurements of linear arrays are discussed and the results are presented in Section 4. Section 5, describes the array fabrication process; silicon shift register scanners are discussed in Section 6. The array evaluation measurements are discussed in Section 7 and finally, conclusions and recommendations are presented in Section 8. GRA

N77-20427# Naval Postgraduate School, Monterey, Calif.
THE DESIGN AND CONSTRUCTION OF A STOPPED FLOW APPARATUS M.S. Thesis. Final Report, Jul. 1970 - Sep. 1976
Kenneth J. Graham and Richard A. Reinhardt 30 Sep. 1976 48 p refs
(AD-A031838; NPS-61R176092) Avail: NTIS HC A03/MF A01 CSCL 07/1

The history of the construction of the stopped-flow apparatus at the Naval Postgraduate School is outlined and the design and characteristics of the present working model are given in considerable detail. Also provided are operating instructions and calibration procedures. Author (GRA)

N77-20747# Institutes fuer Wehrmedizin und Hygiene, Koblenz (West Germany). Defense Physiology Div.
CO DOSE METER FOR WORKING PLACES EXPOSED TO EXTREME PEAKS OF CO-CONTAMINATION
G. Kleinhanss and C. Piekarski *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 5 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-20428*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DISCHARGE STABILIZATION STUDIES OF CO LASER GAS MIXTURES IN QUASI-STEADY SUPERSONIC FLOW
G. Srinivasan and J. A. Smith Oct. 1976 28 p refs
(NASA-TM-X-73201; A-6897) Avail: NTIS HC A03/MF A01 CSCL 20E

Experiments were conducted to study the applicability of a double discharge stabilization scheme in conditions appropriate for high energy CO lasers in supersonic flows. A Ludwieg tube impulse flow facility and a ballasted capacitor bank provided essentially steady flow and discharge conditions (d.c.) for times longer than ten electrode length-flow transit times. Steady, arc-free, volume discharges were produced in a Mach 3 test cavity using an auxiliary discharge to stabilize the main discharge in N2 and He/CO mixture. A signigicant result is the lack of observed plasma E/N changes in response to auxiliary discharge current changes. Also, where glow discharges were obtained, the energy loading achieved was very much less than the threshold level required for laser operation. Author

N77-20429# California Univ., Livermore. Lawrence Livermore Lab.
LASER FUSION OVERVIEW
John Nuckolls 17 May 1976 26 p Presented at Intern. Conf. on Quantum Electron. and Exhibition, Amsterdam, 14 Jun. 1976
(Contract W-7405-eng-48)
(UCRL-77725; Conf-760611-7) Avail: NTIS HC A03/MF A01

Because of recent breakthroughs in the target area, and in the glass laser area, the scientific feasibility of laser fusion and of inertial fusion may be demonstrated in the early 1980's. Then the development in that time period of a suitable laser (or storage ring or other driving source) would make possible an operational inertial fusion reactor in this century. These are roughly the same time scales as projected by the Tokamak magnetic confinement approach. It appears that the 15-20 year earlier start by magnetic confinement fusion may be overcome. Because inertial confinement has been demonstrated, and inertial fusion reactors may operate on smaller scales than Tokamaks, laser fusion may have important technical and economic advantages. ERA

N77-20430# Battelle Columbus Labs., Ohio.
USE OF GLASS TAPE FOR CLADDING OF GLASS LASER DISCS Summary Report
Berry E. Johnson, Russell B. Bennett, and Dale E. Niesz 6 Aug. 1975 28 p Prepared for Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-13655; SANL-385/005) Avail: NTIS HC A03/MF A01

The feasibility of the approach was demonstrated by applying a 0.070-inch-thick coating of cladding glass to an A-size ED-2 laser glass disc. An existing cladding glass composition was used. Developing the equipment and technique required to bond the strip of cladding glass to the elliptical disc was a major part of the program. ERA

N77-20431# California Univ., Livermore. Lawrence Livermore Lab.
ANALYTICAL SOLUTIONS FOR LASER HEATING AND BURNTHROUGH OF OPAQUE SOLID SLABS
Robert J. Harrach 9 Aug. 1976 24 p refs Presented at 20th Ann. SPIE Tech. Symp., San Diego, Calif., 23-27 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-78514; Conf-760832-13) Avail: NTIS HC A02/MF A01

The thermal response of an opaque solid slab exposed to intense laser radiation is described using the heat-balance integral method. The thermophysical properties of the target are assumed to be constant independent of temperature, but the theory accommodates a time-varying laser intensity and a temperature-dependent surface absorptivity. Illustrative burnthrough-time calculations are presented for aluminum, stainless steel, and carbon phenolic targets, covering a wide range of values of target thickness and laser intensity. ERA

N77-20432# Aerospace Corp., El Segundo, Calif.
COMPARATIVE PERFORMANCE OF CHEMICAL LASERS WITH AXISYMMETRIC AND TWO-DIMENSIONAL NOZZLES
Harold Mirels and Walter R. Warren, Jr. 27 Aug. 1976 21 p refs
(Contract F04701-75-C-0076)
(AD-A030933; TR-0076(6725)-3; SAMSO-TR-76-200) Avail: NTIS HC A02/MF A01 CSCL 20/5

Saturated output power from cold-reaction CW HF/DF diffusion type chemical lasers in which axisymmetric or two-dimensional oxidizer nozzles are used is compared for the case where the pumping reaction is fast compared with collisional deactivation. For typical HF laser flow conditions and pw > 5 Torr cm, the axisymmetric nozzle has an output power twice that of a two-dimensional nozzle with the same exit flow, exit pressure p, and exit semiwidth w. In this pw regime, however, the chemical efficiency of the axisymmetric nozzle is 20%, or less, that of a premixed (pw = 0) laser. For pw = 1 Torr cm, the axisymmetric nozzle has about 30% greater output than the corresponding two-dimensional nozzle and a chemical efficiency equal to about 60% that of a premixed laser. For pw < 0.5 Torr cm both nozzles have essentially premixed laser performance. Author

N77-20433# Alabama Univ., Huntsville. School of Graduate Studies and Research.
THEORETICAL INVESTIGATION OF THE LASER AMPLIFICATION PROPERTIES OF A CONTINUOUS WAVE, ELECTRICAL DISCHARGE LASER (CW-EDL) Final Report, May 1975 - Jul. 1976
W. B. McKnight and C. H. Chan Jul. 1976 66 p refs
(Contract DAAH01-75-C-0911)
(AD-A031011; UAH-RR-189) Avail: NTIS HC A04/MF A01 CSCL 20/5

A rigorously-derived paraxial approximation based on scaling the coordinates of the wave equation in terms of natural parameters of the system under consideration was used to study

the behavior of a continuous-wave electric discharge (CW-EDL) laser medium considered as an amplifier for the effects of diffraction, saturation, and detuning of the operating frequency from the center of the gain line, on the quality of the propagating beam. Computer-generated results showed no serious beam degradation from these effects. This formulation was then used, subject to the constraints of the unstable resonator optical cavity, to treat the system as an oscillator, assuming cylindrical symmetry in the loaded resonator. Near-field phase and intensity patterns were obtained by computer, and used to generate far-field patterns. This computer-modelling of the unstable resonator with continuous gain medium is compared to computer models developed by others. Author (GRA)

N77-20434# Battelle Memorial Inst., Columbus, Ohio.
CONTINUED STUDIES OF X-RAY GENERATION BY LASER BEAMS Final Report, 6 Aug. 1973 - 30 Sep. 1974
P. J. Mallozzi Feb. 1976 38 p refs
(Contract DNA001-74-C-0025; DNA Proj. NWED-QAXPF001) (AD-A031759; DNA-3922F) Avail: NTIS HC A03/MF A01 CSCL 20/9

The principal result of this study is the production of 150-200 joules of X-rays with Battelle's 12-beam neodymium-doped-glass laser. The X-rays were produced by focusing twelve 110-joule, 3-1/2 nanosecond laser pulses onto separate points of a copper slab target. Time-dependent measurements of the X-ray output were made with a scintillator and an image converter streak camera. The shape of the X-ray pulse was found to closely follow the laser intensity for pulsewidth between 1-1/2 to 3-1/2 nanoseconds, which was the range of pulsewidths studied. GRA

N77-20435# Cornell Univ., Ithaca, N.Y.
STUDY OF MOLECULAR LASERS Semiannual Report, 1 Oct. 1975 - 1 May 1976
George J. Wolga, Simon H. Bauer, Ross A. McFarlane, and Terrill A. Cool 1 Jun. 1976 9 p refs
(Contract N00014-67-A-0077-0006)
(AD-A031513) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report describes research conducted at Cornell University on molecular and chemical laser systems. The objective of this work has been to provide precise, quantitative information concerning: the rates with which vibrational and rotational molecular energy in important laser molecules is transferred to other molecules, redistributed among the degrees of freedom of the same molecule or relaxed by collisions with molecules or atoms; the temperature dependence of these rates; conditions for rapidly generating high densities of electronically and/or vibrationally excited boron containing diatomics and triatomics; the rates of reaction between various boron hydrides and oxidizers to provide kinetic information relevant to new laser systems; homogeneous chemical reaction initiation by means of laser induced gas heating. The methodology employed consisted of laboratory experiments utilizing: laser induced fluorescence measurements; quantitative EPR determination of atom concentrations; optical double resonance experiments; laser heating with high energy carbon dioxide laser pulses coupled with chemiluminescence spectroscopy. Specific technical results obtained were as follows: (1) a new method for obtaining temperature dependent rates for atom deactivation of molecular vibration was devised; and (2) preliminary experimental results for laser ignited homogeneous chemical reactions of interest to high frequency lasers are described. Author (GRA)

N77-20436# Manchester Univ. (England). Inst. of Science and Technology.
PROPAGATION OF HIGH POWER PULSES OF 10.6 MICROMETERS RADIATION FROM A CO2 TEA LASER OF NOVEL DESIGN THROUGH CLOUDS PRODUCED BY A DIABATIC EXPANSION IN THE LABORATORY Final Technical Report, Feb. - Jul. 1976
P. F. Browne and P. M. Webber Jul. 1976 99 p refs
(Contract DAJA37-74-C-1686)
(AD-A031984) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report describes (1) theory, design and performance of a CO2 TEA laser with VUV preionization delivering typically 25J pulses of duration 0.1 microsecond and beam cross section 20 per sq cm; (2) the production of clouds in the laboratory by adiabatic expansion of compressed gas in a 300 1 glass chamber and the measurement of the cloud parameters (liquid water content, drop radius); (3) measurements of attenuation by such clouds of TEA laser pulses of the above type and also measurement of partial cloud clearing by a CW 10.6 micrometer beam (by recording the change in attenuation of a collinear He-Ne beam); and (4) the theory required to understand the interaction betweeen 10.6 micrometers radiation and clouds of droplets. Author (GRA)

N77-20437# Naval Research Lab., Washington, D.C.
MPLAW: A MULTIPLE-SCALING-LAW CODE USING DATA-BASE INTERPOLATION Interim Report
D. Merritt Cordray 6 Oct. 1976 36 p refs
(NRL Proj. R05-31)
(AD-A032026; NRL-8055) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report describes a program which provides the average focal-plane irradiance of a multiple-pulse truncated-Gaussian laser beam, given the input parameters necessary to describe the laser and the atmospheric conditions. The program contains a data base consisting of 720 data points which were obtained using the NRL propagation code. The irradiance is calculated by linear interpolation (or extrapolation) of a set of points from this data base. The program can be easily modified to use an expanded data base or to accept data for other beam shapes. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-20438 Polish Academy of Sciences, Warsaw.
INTRODUCTION TO GENERAL SYSTEMS THEORY: MULTISEQUENCE DESCRIPTION OF MECHANICAL SYSTEMS; MULTISEQUENCE ORGANIZATION OF PROBLEMS IN MODELLING GENERAL MECHANICAL SYSTEMS [WSTEP DO TEORII SYSTEMOW WIELKICH: OPIS WIELOCIAGOWY SYSTEMOW MECHANICZNYCH; ORGANIZACJA WIELOCIAGOWA ZADAN MODELOWANIA MECHANICZNYCH SYSTEMOW WIELKICH]
Robert Krzywiec 8 Apr. 1976 248 p refs In POLISH
Copyright. Avail: Issuing Activity

The set theory organization is discussed for a general system identified with sets of variable sets of characterizing the system, and sets of transformations, called constraints, defined on those variable sets. An original language of multisequences - multi-index sequences is used as a general system of sequences. Topics discussed include: (1) a multisequence definition of a general system adequate for all general system considerations for formulating and formalizing system problems; (2) a sequence of equivalent representations; (3) linear spaces of multisequences; (4) linear transformations of linear spaces with multi-sequence elements with their multisequence representations and block diagrams; (5) elements of the algebra of multisequences; (6) multigraphs as general systems of graphs equating the notions of multisequence and multigraph; (7) a systematically generalized structure for differential calculation of a multi-sequence real argument, multi-index organization of sets of variables characterizing each system of sets of transformation sets defined on these variable sets; and (8) multisequence organization making possible the construction of proper algebraic, geometric, and other structures. Author

N77-20439# Aeronautical Research Labs., Melbourne (Australia).
CONSTANT-VOLUME GAS TURBINE: FEASIBILITY STUDY SUMMARY REPORT
Feb. 1976 58 p refs
(ARL/ME-147) Avail: NTIS HC A04/MF A01

The application of constant volume combustion to improve compressor and turbine efficiency is investigated. Experiments with valved combustors are described. The performance of radial inflow and axial flow turbines is studied theoretically, and engine system performance is analyzed. Problems associated with constant volume combustion are: (1) the necessity for a comubstor scavenging process; (2) the dominating effect of turbine

efficiency deterioration under pulsating flows; (3) the difficult combustion problem posed by the combination of low fuel-air ratio, low initial temperature and pressure; and (4) the reguirement for rapid combustion. Author

N77-20440*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MANUFACTURING COMPLEXITY ANALYSIS
Leon M. Delionback Feb. 1977 19 p refs
(NASA-TM-X-73373) Avail: NTIS HC A02/MF A01 CSCL 13H

The analysis of the complexity of a typical system is presented. Starting with the subsystems of an example system, the step-by-step procedure for analysis of the complexity of an overall system is given. The learning curves for the various subsystems are determined as well as the concurrent numbers of relevant design parameters. Then trend curves are plotted for the learning curve slopes versus the various design-oriented parameters, e.g. number of parts versus slope of learning curve, or number of fasteners versus slope of learning curve, etc. Representative cuts are taken from each trend curve, and a figure-of-merit analysis is made for each of the subsystems. Based on these values, a characteristic curve is plotted which is indicative of the complexity of the particular subsystem. Each such characteristic curve is based on a universe of trend curve data taken from data points observed for the subsystem in question. Thus, a characteristic curve is developed for each of the subsystems in the overall system. Author

N77-20441*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR AUTOMATICALLY SPRAYING A COATING MATERIAL Patent Application
Max H. Sharpe, William G. Simpson, and James M. Carter, inventors (to NASA) Filed 15 Feb. 1977 19 p
(NASA-Case-MFS-23506-2; US-Patent-Appl-SN-768794) Avail: NTIS HC A02/MF A01 CSCL 13H

A device is described for automatically spraying a coating on an elongated body; e. g., spraying ablative material on a space vehicle. The space vehicle is rotated on a rotatable table in an upright position. A vertically extending support is positioned adjacent the space vehicle and has a housing which is automatically raised and lowered thereon. A spray nozzle is mounted on the housing and is reciprocated up and down so as to spray a predetermined pattern on the space vehicle. A spraying material is carried within a mixing vat and a supply pump is used for pumping the spraying material to the nozzle. NASA

N77-20442*# Princeton Univ., N.J. Dept. of Chemical Engineering.
STRUCTURE-PROPERTY RELATIONSHIPS IN LOW-TEMPERATURE ADHESIVES Final Report 1972 - 1976
C. K. Schoff, K. Udipi, and J. K. Gillham Washington NASA Mar. 1977 92 p refs
(Grant NGR-31-001-272)
(NASA-CR-2718) Avail: NTIS HC A05/MF A01 CSCL 11A

Adhesive materials of aliphatic polyester, linear hydroxyl end-capped polybutadienes, or SBS block copolymers are studied with the objective to replace conventional partially aromatic end-reactive polyester-isocyanate adhesives that have shown undesirable enbrittlement in balloon applications at the service temperatures of -70 C. Author

N77-20443# California Univ., Livermore. Lawrence Livermore Lab.
BATTERY-FLYWHEEL HYBRID ELECTRIC POWER SYSTEM FOR NEAR TERM APPLICATION. VOLUME 2: SYSTEM DESIGN
D. D. Davis, L. G. OConnell, S. E. Warner, A. E. Raynard (AiResearch Mfg. Co., Los Angeles), and B. H. Rowlett (AiResearch Mfg. Co., Los Angeles) 15 Apr. 1976 81 p refs
(Contract W-7405-eng-48)
(UCID-17098-Vol-2) Avail: NTIS HC A05/MF A01

A hybrid system design resulting from an investigation of battery-flywheel power systems for automobiles is presented. Topics include: (1) flywheel design, including sizing and safety; (2) power transmission design with an electromechanical transmission, traction motor, and flywheel motor, (3) control system design; and (4) performance calculations. Using a simplified mathematical model, a comparison is made between the hybrid performance characteristics and those of an all-battery electric vehicle. The hybrid design includes regenerative braking and fly-wheel relief of the drain rate. ERA

N77-20444# Bendix Corp., Kansas City, Mo.
BURRS PRODUCED BY GRINDING
L. K. Gillespie Aug. 1976 34 p refs
(Contract E(29-1)-613)
(BDX-613-1372) Avail: NTIS HC A03/MF A01

An investigation was conducted to determine the influence of variables in controlling the size and repeatability of grinding burrs to minimize burr-removal costs and improve the quality and reliability of parts for small precision mechanisms. Each of the three types of burrs produced by surface-grinding a rectangular block responds differently to changes in cutting conditions. Reducing the downfeed rate generally produces shorter burrs. Although the size of the abrasive grain affected the thickness of one of the burrs, thickness was relatively unaffected by the variables studied. The thickest burrs occurred on low-carbon steel. ERA

N77-20445# California Univ., Livermore. Lawrence Livermore Lab.
THREE DIMENSIONAL NUMERICAL MODELING OF LIQUID FUEL SPRAYS
Charles K. Westbrook 1976 30 p refs Presented at 16th Intern. Symp. on Combustion, Cambridge, Mass., 15 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-77621-Rev-1; Conf-760801-3) Avail: NTIS HC A03/MF A01

A numerical solution technique was developed for the spray equation and applied to thin sprays injected into a type of stratified charge internal combustion chamber. The difference equation method can treat general three dimensional geometries, using a statistical approach. The effects of independent variations of a large number of system parameters were studied, including initial spray dispersion, amount and type of gas swirl, gas density, injection timing, chamber geometry, initial droplet size distribution, injection velocity, drag coefficient, vaporization rate expression, injector aperture size, droplet specific gravity, and direction of injection. It was found that, in the particular geometry chosen, the gas swirl, the droplet size distribution produced by the injector, and the chamber gas density into which the spray is injected are the most important factors influencing the spray motion and vaporization. ERA

N77-20446# Bendix Corp., Kansas City, Mo.
BURRS PRODUCED BY DRILLING
L. K. Gillespie Aug. 1976 107 p refs
(Contract E(29-1)-613)
(BDX-613-1248) Avail: NTIS HC A06/MF A01

Increasing the feedrate resulted in longer exit burrs from 303Se stainless steel and 1018 steel. Drill geometry, workpiece materials, and workpiece thickness also affected the exit-burr length. Radial-lip drills produced shorter exit burrs at fast feedrates in 303Se stainless steel than did the other drills, and they produced thinner exit burrs at all feedrates. Little difference was observed in the results from different drill points used in other materials. Burr size varied with the number of holes drilled in a typical wear-life pattern. Exit-burr thickness was a linear function of exit-burr length for the stainless steel specimens. No relationship between these properties observed for either 1018 steel or 6061-T6 aluminum. The use of a backup material having a hole equal in diameter to that of the drill resulted in significantly shorter and thinner exit burrs than did any other drilling method studied. ERA

N77-20447# Bendix Corp., Kansas City, Mo.
GEAR CUTTING Final Report
R. W. Stiles Aug. 1976 80 p refs
(Contract E(29-1)-613)
(BDX-613-1392; PDO-6984391) Avail: NTIS HC A05/MF A01

A mathematical model and computer program were created that will accurately predict whether a desired ratchet tooth geometry can be produced, and will also design the cutting

tool. The final activity was shaping internal gear teeth. The test data showed that the standard deviations for the high and low pitch diameters were 0.00036 and 0.00056 inch and respectively and that the total composite error had a standard deviation of 0.00051 inch. ERA

N77-20448# Bendix Corp., Kansas City, Mo.
SKIVING Final Report
L. K. Gillespie Aug. 1976 35 p refs
(Contract E(29-1)-613)
(BDX-613-1429; PDO-6989213) Avail: NTIS HC A03/MF A01

Two typical shaft shapes were evaluated through the use of stainless steel. The investigation showed that skiving can maintain plus 0.001 inch tolerances in 303Se stainless steel. Surface finishes of 32 microinches, or less, were produced on 303Se stainless steel. In general, a 16-microinch finish on stainless steel represents a reasonable capability limit for the process. In some instances, better finishes can be produced. An analysis of the costs involved indicates that skiving becomes economical at length-to-diameter ratios of approximately 10:1 ERA

N77-20449# Oak Ridge National Lab., Tenn. Reactor Div.
APPARATUS FOR SPOT WELDING SHEATHED THERMOCOUPLES TO THE INSIDE OF SMALL-DIAMETER TUBES AT PRECISE LOCATIONS
W. E. Baucum and R. E. Dial 28 Jun. 1976 18 p Prepared for the US Nuclear Regulatory Commission
(Contract W-7405-eng-26)
(ORNL/NUREG/TM-33; NRC-2; NRC-3) Avail: NTIS HC A02/MF A01

Spot welding and oxide cleaning tools were fabricated to remove the oxide coating on the Zircaloy tubing at local areas and spot weld four thermocouples separated circumferentially by 90 degree at any axial distribition desired. It was found necessary to apply a nickel coating to stainless-steel-sheathed thermocouples to obtain acceptable welds. The material and shape of the inner electrode and resistance between inner and outer electrodes were found to be critical parameters in obtaining acceptable welds. ERA

N77-20450# Bendix Corp., Kansas City, Mo.
HAND PUNCHING HOLES IN UNFIRED 99.5 PERCENT ALUMINA SUBSTRATES
P. L. Blessner Aug. 1976 28 p
(Contract E(29-1)-613)
(BDX-613-1461) Avail: NTIS HC A03/MF A01

The tooling and process techniques for hand-punching holes in green (unfired) 99.5 percent alumina ceramic substrates were investigated to determine the requirements for obtaining holes with good surface finish and a minimum number of defects. It was determined that holes having excellent surface finish could be obtained with the following processing and tooling: use heat-treated drill bushings to line the template holes; use a conical-tipped punch; use oil as a lubricant; spin the punch approximately five revolutions during the punching operation; and blow compressed air through the hole after punching. The as-fired hole diameter should be approximately 78 percent of the nominal punch diameter. ERA

N77-20451# Energy Research and Development Administration, Bartlesville, Okla. Energy Research Center.
FUEL CONSUMPTION, EMISSIONS AND POWER CHARACTERISTICS OF THE 1975 CHEVROLET 350-CID 2V AUTOMOTIVE ENGINE-EXPERIMENTAL DATA Interim Report, May - Jun. 1975
W. F. Marshall Sep. 1976 41 p Sponsored by DOT
(PB-259330/9; BERC/OP-76/19; DOT-TSC-OST-76-36) Avail: NTIS HC A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of the 1975 Chevrolet, 350 cubic-inch displacement, 2-bbl engine, to determine the steady-state fuel consumption and emissions of hydrocarbon, carbon monoxide and oxides of nitrogen. These data were obtained in detail adequate to construct performance maps for the entire speed/load operating range of the engine. The objective of the test work was to obtain data that describe engine performance characteristics in engineering terms; the data are so presented. The comparative or judgmental assessment of engine performance was not an objective, and such assessment is avoided. GRA

N77-20452# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
FRACTURE MECHANICS ANALYSIS OF SINGLE AND DOUBLE ROWS OF FASTENER HOLES LOADED IN BEARING Interim Report, Feb. - Apr. 1975
Oscar Orringer and George Stalk Apr. 1976 74 p refs
(Contract F33615-74-C-3063)
(AD-A032045; ASRL-TR-177-3; AFFWL-TR-75-71) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report documents a finite-element analysis procedure for computation of Mode I and Mode II stress intensity factors at a cracked fastener hole in a single row or a double staggered row of fastener holes on a tension panel. The panel is loaded by cosine bearing pressure distributions applied to each fastener hole. Different bearing forces may be specified for each hole, and any hole may be designated as the damaged hole. The physical structure, finite-element model, program flow and options, input/output conventions, execution times, and limitations are discussed. Results of some example analyses are presented. GRA

N77-20453# Martin Marietta Labs., Baltimore, Md.
ELECTROMECHANICAL MACHINING Final Report
R. M. Latanision and K. C. Nielsen Jan. 1976 37 p refs
(Contract DAAF03-73-C-0111)
(AD-A031857; RIA-R-CR-76-015) Avail: NTIS HC A03/MF A01 CSCL 13/9

The purpose of this work was to adapt the new process of electromechanical machining (EMM), in which metal is cut by direct contact of the tool with an electrochemically polarized workpiece, to turning and drilling. This investigation, which followed experiments in shaping, was focused on the turning and drilling of commercial alloys, particularly weapons materials such as 4140 steel and CG27 alloy, and the design and construction of a prototype EMM control console. Electromechanical drilling of nickel-base alloys is most effective at potentials in the transpassive range of the polarization diagram for the work-piece in an aqueous Na2SO4 electrolyte. On the other hand, the penetration rate, tool life, cutting forces and hole surface finish experienced when drilling 4140 steel are far superior at active rather than passive, or neutral, potentials. These observations indicate the importance of proper selection of electrolytes and cutting potentials for each alloy of interest. Investigations showed that, at handbook recommendations for cutting speeds and feeds, electromechanical turning of 4140 steel was superior, in terms of cutting forces, to conventional turning. A portable, EMM control console, consisting of a 10-amp potentiostat, power supply, and related control for thermoelectric currents was assembled. Author (GRA)

N77-20454# Norton Co., Worcester, Mass. Industrial Ceramics Div.
CERAMIC MATERIALS IN ROLLING CONTACT BEARINGS Final Report, 15 Mar. 1975 - 15 Sep. 1976
H. Robert Baumgartneer, Glen S. Calvert, and Paul E. Cowley Oct. 1976 75 p refs
(Contract N00019-75-C-0197)
(AD-A031560) Avail: NTIS HC A04/MF A01 CSCL 13/9

The objectives of the program were to design, fabricate and evaluate the performance of a roller bearing having hot-pressed silicon nitride rollers and steel races at speeds up to 71,500 rpm (2.5 million DN). The 35mm bore bearing consists of AISI CVM M50 steel races, fourteen fully crowned NC-132 silicon nitride rollers and a silver plated AMS 6414 steel retainer. Bearing performance was defined in terms of operating temperature, heat generation and vibration at speeds between 30,000 and 71,500 rpm under a predominately 130 pound radial load. Following the calibration testing, the bearing was endurance tested an additional 19 hours at 71,500 rpm. The bearing test operation was smooth and trouble-free. Heat generation of the silicon nitride roller bearing was comparable to that of a similar M50 steel roller bearing. Post-test bearing inspection showed the bearing to be in generally good condition with the major exception of a crack in the inner steel raceway that was caused by the interaction of a contamination dent and a carbide inclusion.

Some roller wobble had occurred, as indicated by retainer pocket wear. Author (GRA)

N77-20455# Grumman Aerospace Corp., Bethpage, N.Y.
SLIDING-SEAL ELECTRON-BEAM WELDING Final Report, Feb. 1973 - Dec. 1975
Harold P. Ellison and Robert H. Witt Jan. 1976 201 p refs
(Contract F33615-73-C-5030)
(AD-A031901; AFML-TR-76-3) Avail: NTIS HC A10/MF A01 CSCL 13/8

A selected aerospace structure (F-14 wing beam) was successfully SSEB welded, thus demonstrating equipment capability to fabricate production parts. Tensile, fatigue and fracture toughness results are presented for a welded wing beam. Recommendations for further improvement or refinement of the SSEB welding equipment are included. A recommended industry equipment and a welding specification for aluminum, titanium and steel alloys are also included. GRA

N77-20456# Franklin Inst. Research Labs., Philadelphia, Pa.
DEVELOPMENT OF COMPLIANT-MOUNTED GAS-BEARINGS FOR A SMALL HIGH-SPEED, 10 KW TURBOALTERNATOR Final Report
Wilbur Shapiro and Richard Colsher Sep. 1976 105 p refs Prepared in cooperation with International Harvester Co., San Diego, Calif.
(Contract DAAK02-72-C-0571)
(AD-A031950; FIRL-I-C3425) Avail: NTIS CSCL 13/9

Several types of compliant-mounted bearings were developed for application to a Solar 10KW Turboalternator Simulator. The most successful journal bearing incorporated one spring-mounted, pad and two fixed pads, all of which pivoted on a compliant-mount. Component testing of these journal bearings were successfully completed to 76,000 RPM which was the limiting speed of the component rig. Simulator testing was accomplished to 65,000 RPM at which time a journal bearing failure occurred. There is evidence to support the conclusion that the failure was not bearing originated but was due to other factors concerned with the rig. After initial installation difficulties were resolved, the compliant mounted thrust bearings performed very well. The results of the program indicated that the final bearing configurations demonstrated encouraging potential for their implementation to high-speed turbomachinery. Author (GRA)

N77-20457# British Steel Corp., Sheffield (England). Information Services.
THE SIGNIFICANCE OF DEFECTS IN H PILE SPLICE WELDS
M. U. Farid and W. P. Tait Aug. 1976 35 p refs
(PB-258933/1; GS/PROD/176/23/76/C) Avail: NTIS HC A03/MF A01 CSCL 13E

Defective splice welds in 'H' pile sections and the effect of misaligned welded sections were investigated to determine the tolerance of splice welds defects (slag, porosity, lack of fusion), and to observe the performance of these defective welds within maximum recommended working stress zone, under the influence of three point bending, direct compression and impact loading. The tests show that 'H' bearing pile containing deliberately produced defects of welds and alignment were well able to withstand loads far in excess of design loads. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-20458# Bendix Corp., Kansas City, Mo.
RAPID VISUAL SCANNING Final Report
R. D. Taylor Aug. 1976 41 p refs
(Contract E(29-1)-613)
(BDX-613-1187; PDO-6984522) Avail: NTIS HC A03/MF A01

A description is given of improvements in equipment and inspection techniques for visual inspection of electronic component assemblies. Comparison devices for enhancing differences between a master and test parts are evaluated. Illumination methods and television inspection developments were investigated. Indexing devices were evaluated and improved optical systems and methods were developed. An effective low-cost television comparison system was built; this system uses techniques such as blinking and subtraction for detecting differences in printed circuit boards. A glare-free illumination system called omnidirectional illumination was also developed and tested. This system reduces eyestrain, and performs very well on all types of surfaces and especially well on highly polished substrates. A low-cost manual indexing system called the Pantograph was designed and tested for quick, precise positioning of small circuit boards. ERA

N77-20459# Oak Ridge National Lab., Tenn.
ULTRASONIC PULSE SPECTROMETRY
1976 3 p Transl. into ENGLISH from German Report
(Contract W-7405-eng-26)
(ORNL-TR-4145) Avail: NTIS HC A02/MF A01

Generally, it is required that nondestructive testing methods describe as accurately as possible the flaws found in a specimen by answering the questions: (1) where, (2) what, (3) how large; and (4) how oriented. The ultrasonic echo method makes it possible to answer the first of these questions but not the other three. The application of ultrasonic pulse echo spectrometry is an attempt to make a closer approach to the answer to these three questions. ERA

N77-20460# Bendix Corp., Kansas City, Mo.
BEAM LEAD DEVICE TEMPERATURE TESTING
L. W. Brown Aug. 1976 30 p refs
(Contract E(29-1)-613)
(BDX-613-1275) Avail: NTIS HC A03/MF A01

The ability to perform 100-percent electrical probe testing of beam lead devices (BLD) at temperatures from 0 to 50 C was developed. Correlation of probe test results to bonded sample test results from -55 to 100 C was established for some parameters on transistors, diodes, and Zener diodes. The tests performed on transistors included collector-to-emitter leakage, collector-to-base leakage, current gain, and collector-emitter saturation voltages. Reverse leakage current tests were performed on diodes and Zener diodes in addition to forward voltage drop on diodes and Zener voltage on Zener diodes. It was determined from these tests that, in nearly all cases, probe testing can be performed at room temperature to assure a limit at temperature extremes once the exact temperature dependence of the parameter is known for a lot of devices. ERA

N77-20461# Bendix Corp., Kansas City, Mo.
NONDESTRUCTIVE TESTING OF WELDED ELECTRICAL CONNECTORS Final Report
E. B. Cooper Aug. 1976 22 p Revised
(Contract E(29-1)-613)
(BDX-613-1190-Rev) Avail: NTIS HC A02/MF A01

A nondestructive inspection technology for welded electrical connectors is described. Emphasis was on percussive arc welds. While inspection of piece parts was the primary goal, nondestructive inspection of special samples used to control production also was considered. The ultrasonic pulse echo pattern of a percussive arc weld was charged when the weld schedule was changed. This technique discriminated between samples made by different schedules with better than 99 percent reliability. The average infrared emission from several samples of the same schedule correlated with schedule information. During a brief search for alternative destructive tests, it was found that a 30 g vibration test at the resonance frequency of the welded sample showed promise. This test showed good capability for discriminating between weld schedules and always resulted in failures of the weld, not the wire. ERA

N77-20462# European Space Agency, Paris (France).
PRESENT AND FUTURE PROGRAMME RELATED TO HIGH RELIABILITY PARTS IN EUROPE
H. Arciszewski and D. A. Nutt 1976 21 p Presented at the U S Reliability and Maintainability Symp., Las Vegas, Nev., 20-22 Jan. 1976
Avail: NTIS HC A02/MF A01

The Space Components Coordination Group (SCCG) of ESA

is described. The philosophy relating to high reliability parts, adopted as a common European policy, is discussed and the present status of the SCCG specification system for space components is detailed. In parallel with its activities in the specification system, ESA has initiated a European alert system and has set up a databank for electronic parts. ESA

N77-20463# Naval Electronics Lab. Center, San Diego, Calif.
MICROWAVE TUBE RELIABILITY Research and Development Report, Jul. 1974 - Dec. 1975
M. Katzman and R. H. Willis 1 Jun. 1976 43 p
(AD-A031026; NELC-TR-1975A) Avail: NTIS HC A03/MF A01 CSCL 09/1

Data obtained from tube manufacturers, system manufacturers, and users point to problems resulting from low-volume production, technological gaps, lack of failure data feedback to the manufacturer, limited development funding, inadequate reliability assurance, and the lack of a comprehensive program of repair and recycle. Past efforts to improve reliability are surveyed. Government-industry interaction is discussed, and it is suggested that it might be appropriate to encourage the continued survival of the remaining manufacturers of microwave tubes. Specific development programs are recommended in support of high-power tubes in the areas of airborne systems, shipboard systems, and support technology. GRA

N77-20464# California Univ., Berkeley. Operations Research Center.
A RENEWAL DECISION PROBLEM
C. Derman, G. J. Lieberman, and S. M. Ross Sep. 1976 21 p refs
(Grants DAAG29-76-G-0042; DAHC04-75-G-0163; ARO Proj. P-13179-M)
(AD-A031413; ORC-76-28) Avail: NTIS HC A02/MF A01 CSCL 12/2

A system must operate for t units of time. A certain component is essential for its operation and must be replaced, when it fails, with a new component. The class of spare components is grouped into n categories with components of the Ith category costing a positive amount (C sub i) and functioning for an exponential length of time with rate (lambda sub i). The main problem of interest is, for a given t, to assign the initial component and subsequent replacements from among the n categories of spare components so as to minimize the expected cost of providing an operative component for t units of time. GRA

N77-20465# Picatinny Arsenal, Dover, N.J.
STATE-OF-THE-ART SURVEY FOR AUTOMATIC OPTICAL DETECTION OF SURFACE DEFECTS ON ORDNANCE MATERIAL
Edward G. Kessler Sep. 1976 44 p refs
(AD-A031001; PA-TR-4880) Avail: NTIS HC A03/MF A01 CSCL 17/8

This state-of-the-art survey is aimed towards optical procedures that might prove useful in detecting defects (such as cracks, blemishes, pits, and missing or out-of-tolerance components) typically found in ordnance items. Included in this report are sections on color, diffraction, reticles, scatter, optical spatial filters, mechanical and electronic optical scanning systems, and analog-digital electronic information analysis. It is found in general that the ability to resolve a defect has an inverse relationship to the complexity of the background. If the background is sufficiently subdued, a simple photodetector circuit will serve. It is concluded that the design engineer must carefully evaluate the specific problem in order to obtain the simplest, most cost effective defect detection system that meets quality control criteria. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-20466 Engineering Sciences Data Unit, London (England).
THE RESPONSE OF FLEXIBLE STRUCTURES TO ATMOSPHERIC TURBULENCE Data Item
Sep. 1976 49 p
(ESDU-76001; ISBN-0-85679-155-5) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

Shear forces, bending moments, deflections, and accelerations experienced by flexible structures when caused to vibrate in the alongwind direction by the action of the turbulent wind are described. The results obtained can aid in the structural design of ground based structures such as stacks, towers, bridges, and buildings against the action of atmospheric wind loads. Dissert. Abstr.

N77-20467 Engineering Sciences Data Unit, London (England).
ELASTIC STRESSES AND DEFLECTIONS UNDER UNIFORM PRESSURE OF FLAT RECTANGULAR SANDWICH PANELS; LONG EDGES CLAMPED, SHORT EDGES SIMPLY-SUPPORTED (ISOTROPIC FACE PLATES AND ORTHOTROPIC-CORES OF ZERO FLEXURAL STIFFNESS) Data Item
Sep. 1976 13 p
(ESDU-76022; ISBN-0-85679-159-8) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. (write for prices)

Curves are given for the maximum deflection and the maximum direct and shear stresses in initially flat rectangular sandwich panels of uniform thickness with long edges clamped and short edges simply-supported of various length to width ratios under uniform normal pressure. The face plates are isotropic and have the same value of Poisson's ratio; however they can be of different thicknesses and have different moduli of elasticity. The core material may be either isotropic or orthotropic. It is assumed that while the core provides a shear path between the faces, its own flexural stiffness makes no significant contribution to that of the panel. Dissert. Abstr.

N77-20468 Polish Academy of Sciences, Warsaw.
BASES OF THE THEORY OF OPTIMAL CONTROL AND ITS APPLICATION IN THE MECHANICS OF DEFORMATION BODIES [PODSTAWY TEORII STEROWANIA OPTYMALNEGO ORAZ JEJ ZASTOSOWANIA W MECHANICE CIAL ODKSZTALCALNYCH]
Uelo Lepik 8 Sep. 1976 53 p refs In POLISH
Copyright. Avail: Issuing Activity

The theory of optimal control is explained along with connection between this theory and the classical calculus of variations. Mechanical applications of the theory are surveyed and its application to the theory of elasticity and plasticity is discussed. Author

N77-20469 Polish Academy of Sciences, Warsaw.
THE CURVE LINES THEORY: TABLES OF SOLUTIONS FOR RECTANGULAR PLATES WITH ONE FREE EDGE [TEORIA LINII ZALOMOW: TABLICE ROZWIAZAN DLA PLYT PROSTOKATNYCH O JEDNYM BRZEGU SWOBODNYM]
Joanna Sokol-Supel 2 Aug. 1976 50 p refs In POLISH
Copyright. Avail: Issuing Activity

The validity of the curve lines method in estimating limital load capacity of reinforced concrete plates is demonstrated. The basic principles of the curve lines method are given along with a set of solutions performed by the method for rectangular plates with one free edge. An example illustrating how to use the tables and charts presented is included. Author

N77-20470 Polish Academy of Sciences, Warsaw.
THE FAST OSCILLATIONS METHOD IN SPATIAL PROBLEMS OF THE THEORY OF ELASTICITY OF MULTIPHASE MEDIUMS [METODA SZYBKIEJ OSCYLACJI W PRZESTRZENNYCH ZAGADNIENIACH TEORII SPREZYSTOSCI OSRODKOW WIELOFAZOWYCH]
16 Jun. 1976 17 p refs In POLISH
Avail: Issuing Activity

The solution of multiphase medium problems by the so-called fast oscillation method is reported, by which the structural heterogeneity of a material is defined by oscillating periodic

coefficient functions. The method makes it possible to construct effective solutions of boundary problems. This paper presents universal (in terms of ability to solve diverse problems) solutions of spatial problems of the theory of plasticity for multiphase mediums. It is demonstrated that the fast oscillation method makes it possible to specially analyze concrete boundary problems concerning the theory of elasticity for randomly heterogeneous media. There is some doubt, however, as to the concurrence of the series occurring here and the exactness of the solutions. Analysis of planar problems by the theory of elasticity for randomly heterogeneous media shows that the method of successive approximations in a definite range of parameters gives good concurrences. Author

N77-20471 Polish Academy of Sciences, Warsaw.
OPTIMALIZING CROSS-SECTIONS OF PRESTRESSED BEAMS [OPTYMALIZACJA PRZEKROJOW POPRZECZNYCH BELEK SPREZONYCH]
Wojciech Marks 12 May 1976 59 p refs In POLISH
Copyright. Avail: Issuing Activity

The general problem of optimalizing prestressed concrete beams is considered with the idea of simultaneously applying the concepts and methods of mathematical programming and existing knowledge on the shaping of construction elements not only in formulating objective and limitational functions but also in the very process of seeking solutions. The task is formulated as a nonlinear programming problem; in addition, in working out an algorithm for the solution, information on the work of prestressed elements is exploited. Results confirm the assumption that the solutions are those points of a space of decision variables which have a definite mechanic interpretation, e.g., efforts in certain points of construction elements are used in a corresponding state of load. Author

N77-20472# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE-CRACK GROWTH AND FRACTURE IN D6AC STEEL
N. E. Ryan Sep. 1976 34 p refs
(ARL/MAT-368) Avail: NTIS HC A03/MF A01

Work on fatigue-crack growth and fracture in steel having differing tensile properties and fracture toughness values is reviewed. No simple correlation exists between tensile strength and toughness and, basically, fatigue crack-growth rates were independent of both these properties. The observations are interpreted in terms of the effects of variations of microstructure on deformation and fracture mechanisms. Some work using variable-amplitude loading showed transient effects after load changes. Environmental factors were also studied and it was concluded that simple additivity of fatigue and stress-corrosion could not be used to account for crack-growth rates under corrosive environments. Various laws, developed from fracture mechanics concepts to express crack-growth rates on a function of stress-intensity amplitudes, are discussed. Author

N77-20473# Aeronautical Research Labs., Melbourne (Australia).
A MODEL OF CRACK-TIP BEHAVIOUR FOR FATIGUE LIFE DETERMINATION
F. P. Bullen, J. A. Retchford, C. B. Rogers, and B. J. Wicks Sep. 1976 21 p refs
(ARL/MAT-369) Avail: NTIS HC A02/MF A01

The approach described here is directed at providing data which would improve the evaluation of fatigue life by simulating the performance of critically stressed areas of a structure using individual tests on small specimens. The experiments which are presented in support of this approach have been carried out on polycrystalline copper, since the physical basis of crack-tip behavior in this simple metal is also applicable to conventional aircraft materials. It is shown that, in these materials, cracks propagate under cyclic loading as a result of irreversible plastic strain, and a parameter describing the plastic strain at the crack tip is defined which is shown to be directly related to the rate of crack propagation. Author

N77-20474# Aeronautical Research Labs., Melbourne (Australia).
THE USE OF ADHERENT ALUMINUM FOILS FOR FATIGUE METERING
R. A. Coyle and M. E. Packer Aug. 1976 24 p refs To be presented at the A. R. L. Symp. on Aircraft Structural Fatigue
(ARL/Mat-TM-363) Avail: NTIS HC A02/MF A01

Aluminum foils attached to fatigue specimens show an increase of intensity of the 511,333 X-ray diffraction line as a result of cycling and the increase is shown to arise from changes in texture. It is confirmed that this phenomenon can be used as the basis of a fatigue meter in certain situations. However, it is unlikely to be of general use in the aeronautical field because of its insensitivity to repeated-tension cycles. Author

N77-20475# Aeronautical Research Labs., Melbourne (Australia).
NDI AND THE DETECTION OF FATIGUE
I. G. Scott Aug. 1976 21 p refs Proposed for Presentation at ARL Symp. on Aircraft Struct. Fatigue
(ARL/Mat-TM-364) Avail: NTIS HC A02/MF A01

The problems of monitoring fatigue cracks by nondestructive investigation (NDI) are discussed and recent developments in the methods and techniques are reviewed. Three aspects of work at A.R.L. are considered in some detail, viz (1) the part played by the operator in NDI, (2) applications of acoustic emission to fatigue studies, and (3) future trends in NDI. Some new philosophies in fatigue testing are also considered. Author

N77-20476# Aeronautical Research Labs., Melbourne (Australia).
MECHANISMS OF FATIGUE AND FRACTURE
S. P. Lynch Aug. 1976 38 p refs To be presented at the A. R. L. Symp. on Aircraft Structural Fatigue
(ARL/Mat-TM-367) Avail: NTIS HC A03/MF A01

Overload fracture, liquid-metal embrittlement, stress corrosion cracking, fatigue-crack initiation, fatigue crack growth and corrosion fatigue are discussed and related. Observations suggest that crack growth in many metallic materials generally occurs by plastic flow and that fracture characteristics are determined mainly by the distribution of slip around crack tips. This distribution governs ductile versus brittle behavior and is influenced by microstructure, stress intensity, temperature and environment; the effects of environment are attributed mainly to chemisorption at crack tips. Changes in microstructure induced by cyclic stress, and the association of such changes with initiation and growth of fatigue cracks, are also examined. Relationships between crack growth rates and stress intensity factors, and the application of mechanistic understanding are explored. Author

N77-20477# Aeronautical Research Labs., Melbourne (Australia).
LOAD INTERACTION EFFECTS IN FATIGUE CRACK PROPAGATION
G. W. Revill, V. Ningaiah, and J. M. Finney Aug. 1976 37 p refs To be presented at the A. R. L. Symp. on Aircraft Structural Fatigue
(ARL/Struc-TM-257) Avail: NTIS HC A03/MF A01

Various proposed mechanisms of load interaction are described as well as models for quantitative predictions. The models all incorporate the extent or crack tip plasticity into the Paris formulation of fatigue crack growth. They do not accurately detail the course of crack growth through the interaction period. It is concluded that satisfactory prediction of interaction effects will require some materials information, obtainable only by test. Author

N77-20478# Aeronautical Research Labs., Melbourne (Australia).
FRACTURE MECHANICS FUNDAMENTALS WITH REFERENCE TO AIRCRAFT STRUCTURAL APPLICATIONS
B. C. Hoskin Aug. 1976 57 p refs To be presented at the A. R. L. Symp. on Aircraft Structural Fatigue
(ARL/Struc-TM-245) Avail: NTIS HC A04/MF A01

Fracture mechanics is being increasingly applied to problems associated with cracked, or potentially cracked, aircraft structures. Such applications include assessment of the residual strength of cracked components and also the prediction of fatigue crack growth. However, fracture mechanics is still very much a developing subject even as regards its fundamentals and, hence, in any application, it is important to bear in mind the limitations associated with some of its results. A survey is made of basic fracture mechanics, with emphasis on those limitations likely to be of importance in aircraft structural applications. Author

N77-20479# Aeronautical Research Labs., Melbourne (Australia).
DEVELOPMENT OF A LOAD SEQUENCE FOR A STRUCTURAL FATIGUE TEST

P. J. Howard Aug. 1976 20 p refs To be presented at A. R. L. Symp. on Aircraft Structural Fatigue
(ARL/Struc-TM-247) Avail: NTIS HC A02/MF A01

A flight-by-flight test load sequence for Mirage was generated using fatigue meter data to give flight order and load spectra, and flight trial data to provide within-flight load sequencies.
Author

N77-20480# Aeronautical Research Labs., Melbourne (Australia).
THE DEVELOPMENT OF THE THEORY OF STRUCTURAL FATIGUE
D. G. Ford Aug. 1976 41 p refs Proposed for presentation at ARL Symp. on Aircraft Structural Fatigue
(ARL/Struc-TM-248; ICAF-900) Avail: NTIS HC A03/MF A01

The relation of structural fatigue to other branches of fatigue is outlined by a brief historical survey which includes the main ideas of the theory and ends with some of the current problems and possible developments. In the sections about cumulative damage and reliability there are some minor improvements over previous formulations.
Author

N77-20481# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE S/N DATA IN RELATION TO VARIABILITY IN PREDICTED LIFE
J. M. Finney and J. Y. Mann Aug. 1976 40 p refs Proposed for presentation at ARL Symp. on Aircraft Structural Fatigue
(ARL/Struc-TM-249; ICAF-901) Avail: NTIS HC A03/MF A01

A survey soliciting eye-drawn curves to two sets of S/N data points resulted in average ranges of predicted life under several multiload level spectra of 3:1 and 2.4:1 for a group of persons experienced in drawing S/N curves. An inexperienced group gave a significantly wider range. Five mathematical methods of curve fitting were applied to one set of data points, with the resultant average range in predicted life being 1.4:1. This variability arises mainly from the subjective choice of a functional form for the S/N curve. The added variability due to other arbitrarily chosen constraints such as weighting, the non-intersection of curves within a family, and the choice of a fatigue limit, is discussed. Many factors associated with the determination of fatigue data influence the resultant S/N relationship and some of the more significant ones are considered. The specific data presented for these various factors give variations in S/N life, and hence in predicted life, ranging from 1.5:1 up to 10:1.
Author

N77-20482*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FATIGUE CRITERION FOR THE DESIGN OF ROTATING SHAFTS UNDER COMBINED STRESS
Stuart H. Loewenthal Mar. 1977 9 p refs
(NASA-TM-X-73639; E-9141) Avail: NTIS HC A02/MF A01 CSCL 13M

A revised approach to the design of transmission shafting which considers the flexure fatigue characteristics of the shaft material under combined cyclic bending and static torsion stress is presented. A fatigue failure relation, corroborated by published combined stress test data, is presented which shows an elliptical variation of reversed bending endurance strength with static torsional stress. From this elliptical failure relations, a design formula for computing the diameter of rotating solid shafts under the most common condition of loading is developed.
Author

N77-20483# Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuigbouwkunde.
AN ASYMPTOTIC ANALYSIS OF A PLATE WITH A CIRCULAR HOLE
A. M. A. VanDerHeijden Mar. 1976 86 p refs
(WTHD-78; Rept-581) Avail: NTIS HC A05/MF A01

The three dimensional linear theory of elasticity is the starting point for the study of an infinite plate with a circular hole. Problems explored are: (1) the plate loaded by bending couples at infinity; (2) the plate loaded by tensile forces at infinity; and (3) the plate faces loaded and the edge of the hole loaded in such a way that the plate is in equilibrium. The shortcomings of the classical theory of plates, and the theory of generalized plane stress are discussed.
Author

N77-20484*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DESIGN PROCEDURES FOR FLUTTER-FREE SURFACE PANELS Final Report
Robert M. Laurenson and J. I. McPherson Washington NASA Mar. 1977 127 p refs
(Contract NAS1-12436)
(NASA-CR-2801) Avail: NTIS HC A07/MF A01 CSCL 13M

An approach for the design of lightweight external surface panel configurations to preclude panel flutter was developed. Design procedures were developed for flat orthotropic panels under the interacting influence of parameters such as support flexibility, inplane loads, pressure differential, and flow angularity. The basic relationships required to define these design procedures were based on theoretical panel flutter analyses. Where possible, the design procedures were verified through comparison with available experimental panel flutter data.
Author

N77-20485*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASTRAN: USER'S EXPERIENCES
Washington Oct. 1976 569 p refs 5th Colloq. held at Moffett Field, Calif., 5-6 Oct. 1976
(NASA-TM-X-3428; A-6709) Avail: NTIS HC A24/MF A01 CSCL 13M

The application of NASTRAN to a wide variety of static and dynamic structural problems is discussed. The following topics are focused upon: (1) methods of analysis; (2) hydroelastic methods; (3) complete analysis of structures; (4) elements and material studies; (5) critical comparisons with other programs; and (6) pre- and post-processor operations. For individual titles, see N77-20486 through N77-20511.

N77-20486*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA'S PLANS FOR FUTURE NASTRAN CAPABILITY
Deene J. Weidman *In its* NASTRAN: User's Experiences Oct. 1976 p 1-2 ref (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

Improvements in the NASTRAN systems management office are presented. Among the improvements are the following items: (1) the FEER eigenmethod and its extension to complete eigenvalue problems; (2) the addition of a supersonic flutter package which allows gust response calculations and active control effects as well; (3) the provisions for a general purpose data generator and (4) some additional advanced rigid, member-ane, plate, and shell elements. In addition to capabilities mentioned, an error correction information system is also introduced.
Author

N77-20487*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON MODELING AND THE USE OF THE NASTRAN THERMAL ANALYZER
Hwa-Ping Lee *In its* NASTRAN: User's Experiences Oct. 1976 p 3-20 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

Eight alternative modeling techniques to specify prescribed temperature at grid or scalar points for transient thermal analyses are presented. Four cases are for constant temperatures, and the others are time varying temperature functions. Theoretical explications and detailed listing of input data cards used for illustrating different modelings are given. It is shown that the NTA is exploited to extend beyond its normal capabilities through innovative modeling techniques. In addition, the effect of node valency on the energy distribution grid points is illustrated and discussed. Guidelines to delineate this effect are given.
Author

N77-20488*# Israel Aircraft Industries Ltd., Lod.
EFFICIENT REANALYSIS OF STRUCTURES BY A DIRECT MODIFICATION METHOD
A. I. Raibstein, I. Kalev, and A. Pipano *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 21-52 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

A procedure for the local stiffness modifications of large structures is described. It enables structural modifications without

an a priori definition of the changes in the original structure and without loss of efficiency due to multiple loading conditions. The solution procedure, implemented in NASTRAN, involved the decomposed stiffness matrix and the displacement vectors of the original structure. It solves the modified structure exactly, irrespective of the magnitude of the stiffness changes. In order to investigate the efficiency of the present procedure and to test its applicability within a design environment, several real and large structures were solved. The results of the efficiency studies indicate that the break-even point of the procedure varies between 8% and 60% stiffness modifications, depending upon the structure's characteristics and the options employed. Author

N77-20489*# Lockheed-California Co., Burbank.
AUTOMATED FULLY-STRESSED DESIGN WITH NASTRAN
D. V. Wallerstein and G. W. Haggenmacher *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 53-66 ref (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

An automated strength sizing capability is described. The technique determines the distribution of material among the elements of a structural model. The sizing is based on either a fully stressed design or a scaled feasible fully stressed design. Results obtained from the application of the strength sizing to the structural sizing of a composite material wing box using material strength allowables are presented. These results demonstrate the rapid convergence of the structural sizes to a usable design. Author

N77-20490*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF NASTRAN TO LARGE DEFLECTION SUPERSONIC FLUTTER OF PANELS
Chuh Mei (Vought Corp., Hampton, Va.) and James L. Rogers, Jr. *In its* NASTRAN: User's Experiences Oct. 1976 p 67-98 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

Flat panel flutter at high supersonic Mach number is analyzed using NASTRAN Level 16.0 by means of modifications to the code. Two-dimensional plate theory and quasi-steady aerodynamic theory are employed. The finite element formulation and solution procedure are presented. Modifications to the NASTRAN code are discussed. Convergence characteristics of the iteration processes are also briefly discussed. Effects of aerodynamic damping, boundary support condition and applied in-plane loading are included. Comparison of nonlinear vibration and linear flutter results with analytical solutions demonstrate that excellent accuracy is obtained with NASTRAN. Author

N77-20491*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL ANALYSES OF THE INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) SCIENTIFIC INSTRUMENT USING THE NASTRAN THERMAL ANALYZER (NTA): A GENERAL PURPOSE SUMMARY
Clifton E. Jackson, Jr. *In its* NASTRAN: User's Experiences Oct. 1976 p 99-118 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

The NTA Level 15.5.2/3, was used to provide non-linear steady-state (NLSS) and non-linear transient (NLTR) thermal predictions for the International Ultraviolet Explorer (IUE) Scientific Instrument (SI). NASTRAN structural models were used as the basis for the thermal models, which were produced by a straight forward conversion procedure. The accuracy of this technique was sub-sequently demonstrated by a comparison of NTA predicts with the results of a thermal vacuum test of the IUE Engineering Test Unit (ETU). Completion of these tasks was aided by the use of NTA subroutines. Author

N77-20492*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GSFC NASTRAN THERMAL ANALYZER NEW CAPABILITIES
Hwa-Ping Lee and Robert L. Harder (MacNeal-Schwendler Corp.) *In its* NASTRAN: User's Experiences Oct. 1976 p 119-126 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

An overview of four analysis capabilities, which developed and integrated into the NASTRAN Thermal Analyzer, is given. To broaden the scope of applications, these additions provide the NTA users with the following capabilities: (1) simulating a thermal louver as a means of the passive thermal control, (2) simulating a fluid loop for transporting energy as a means of the active thermal control, (3) condensing a large sized finite element model for an efficient transient thermal analysis, and (4) entering multiple boundary condition sets in a single submission for execution in steady state thermal analyses. Author

N77-20493*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REAL EIGENVALUE ANALYSIS IN NASTRAN BY THE TRIDIAGONAL REDUCTION (FEER) METHOD
Malcolm Newman (Analytical Mechanics Assoc., Inc.), Paul F. Flanagen (Analytical Mechanics Assoc., Inc.), and James L. Rogers, Jr. *In its* NASTRAN' User's Experiences Oct. 1976 p 127-148 (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

Implementation of the tridiagonal reduction method for real eigenvalue extraction in structural vibration and buckling problems is described. The basic concepts underlying the method are summarized and special features, such as the computation of error bounds and default modes of operation are discussed. In addition, the new user information and error messages and optional diagnostic output relating to the tridiagonal reduction method are presented. Some numerical results and initial experiences relating to usage in the NASTRAN environment are provided, including comparisons with other existing NASTRAN eigenvalue methods. Author

N77-20494*# Computer Sciences Corp., Los Angeles, Calif.
A COMPARISON OF THE TWO NASTRAN DIFFERENTIAL STIFFNESS TECHNIQUES
John R. McDonough *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 149-160 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

NASTRAN contains two techniques to solve the differential stiffness problems. One is incorporated in a new static analysis rigid format and the other is contained in a new normal modes analysis rigid format. The two techniques relative to computational accuracy and time of execution are compared. Author

N77-20495*# Sargent and Lundy, Engineers, Chicago, Ill.
DEFORMATIONS OF THICK TWO-MATERIAL CYLINDER UNDER AXIALLY VARYING RADIAL PRESSURE
Yakub A. Patel *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 161-176 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

Stresses and deformations in thick, short, composite cylinder subjected to axially varying radial pressure are studied. Effect of slippage at the interface is examined. In the NASTRAN finite element model, multipoint constraint feature is utilized. Results are compared with theoretical analysis and SAP-IV computer code. Results from NASTRAN computer code are in good agreement with the analytical solutions. Results suggest a considerable influence of interfacial slippage on the axial bending stresses in the cylinder. Author

N77-20496*# Aerospace Corp., El Segundo, Calif.
A NUMERICALLY EFFICIENT FINITE ELEMENT HYDROELASTIC ANALYSIS
Robert N. Coppolino *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 177-206 refs (For primary document see N77-20485 11-39)
(Contract NAS1-10635)
Avail: NTIS HC A24/MF A01 CSCL 13M

A finite element hydroelastic analysis formulation is developed on the basis of Toupin's complementary variational principle. Emphasis is placed on the special case of an incompressible fluid model which is applicable to propellant tank hydroelastic analysis. A concise fluid inertia representation results from the assumption of incompressibility and the hydroelastic equations reduce to a simplified form associated with the structure alone.

The efficiency of the incompressible hydroelastic formulation in unhanced for both fluid and structure by introduction of harmonic reduction as an alternative to Guyan reduction. The theoretical developments are implemented in the NASTRAN Program and the technique is verified and demonstrated as an efficient and accurate approach with a series of illustrative problems including the 1/8 scale space shuttle external tank. Author

N77-20497*# Naval Ship Research and Development Center, Washington, D.C.
A NASTRAN IMPLEMENTATION OF THE DOUBLY ASYMPTOTIC APPROXIMATION FOR UNDERWATER SHOCK RESPONSE
Gordon C. Everstine *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 207-228 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

A detailed description is given of how the decoupling approximation known as the doubly asymptotic approximation is implemented with NASTRAN to solve shock problems for submerged structures. The general approach involves locating the nonsymmetric terms (which couple structural and fluid variables) on the right hand side of the equations. This approach results in coefficient matrices of acceptable bandwidth but degrades numerical stability, requiring a smaller time step size than would otherwise be used. It is also shown how the structure's added (virtual) mass matrix, is calculated with NASTRAN. Author

N77-20498*# Naval Underwater Systems Center, Newport, R.I.
A SUMMARY OF NASTRAN FLUID/STRUCTURE INTERACTION CAPABILITIES
Anthony J. Kalinowski and Jayant S. Patel *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 229-250 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

A summary of fluid/structure interaction capabilities for the NASTRAN computer program is presented. Indirect applications of the program towards solving this class of problem were concentrated on. For completeness and comparitive purposes, direct usage of NASTRAN is briefly discussed. The solution technology addresses both steady state and transient dynamic response problems. Author

N77-20499*# Naval Ship Research and Development Center, Washington, D.C.
A FINITE ELEMENT-ANALYTICAL METHOD FOR MODELING A STRUCTURE IN AN INFINITE FLUID
P. Richard Zarda *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 251-272 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

A method is described from which the interaction of an elastic structure with an infinite acoustic fluid is determined. The displacements of the structure and the pressure field of the immediate surrounding fluid are modeled by finite elements, and the remaining pressure field of the infinite fluid region is given by an analytical expression. This method yields a frequency dependent boundary condition for the outer fluid boundary when applied to the frequency response of an elastic beam in contact with an acoustic fluid. The frequency response of the beam is determined using NASTRAN, and compares favorably to the exact solution which is also presented. The effect of the fluid on the response of the structure at low and high frequencies is due to added mass and damping characteristics, respectively. Author

N77-20500*# Bell Helicopter Co., Fort Worth, Tex.
DEVELOPMENT, DOCUMENTATION AND CORRELATION OF A NASTRAN VIBRATION MODEL OF THE AH-1G HELICOPTER AIRFRAME
J. D. Cronkhite *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 273-294 refs (For primary document see N77-20485 11-39)
(Contracts NAS1-13801; DAAF03-73-C-0122)
Avail: NTIS HC A24/MF A01 CSCL 13M

NASTRAN was evaluated for vibration analysis of the helicopter airframe. The first effort involved development of a NASTRAN model of the AH-1G helicopter airframe and comprehensive documentation of the model. The next effort was to assess the validity of the NASTRAN model by comparisons with static and vibration tests. Author

N77-20501*# Grumman Aerospace Corp., Bethpage, N.Y.
APPLICATION OF NASTRAN TO LARGE SPACE STRUCTURES
T. Balderes, J. Zalesak, V. DyReyes, and E. Lee *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 295-330 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

The application of NASTRAN to design studies of two very large-area lightweight structures is described. The first is the Satellite Solar Power Station, while the second is a deployable three hundred meter diameter antenna. A brief discussion of the operation of the SSPS is given, followed by a description of the structure. The use of the NASTRAN program for static, vibration and thermal analysis is illustrated and some results are given. Next, the deployable antenna is discussed and the use of NASTRAN for static analysis, buckling analysis and vibration analysis is detailed. Author

N77-20502*# Gates Learjet Corp., Denver, Colo.
ANALYSIS OF THE LEARJET 35/36 WING AND CORRELATION WITH EXPERIMENTAL RESULTS
Mike H. Abla, Robert R. Boroughs, and Everett L. Cook (Wichita State Univ.) *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 331-352 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

Two NASTRAN models of the Gates Learjet Corporation Model 35/36 Wing were developed. The models and the problems encountered in their development are discussed. A skin buckling analysis used for the ultimate loading conditions is presented. A discussion of the static tests and the correlation of the static test with the NASTRAN results and the results of a supplementary semimonocoque beam analysis are also included. Author

N77-20503*# Boeing Vertol Co., Philadelphia, Pa.
THERMAL AND STRUCTURAL ANALYSIS OF HELICOPTER TRANSMISSION HOUSINGS USING VASTRAN
R. W. Howells, J. J. Sciarra, and G. Shek Ng *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 353-380 refs (For primary document see N77-20485 11-39)
(Contracts DAAJ02-75-C-0053; DAAJ02-74-C-0040)
Avail: NTIS HC A24/MF A01 CSCL 13M

The application of NASTRAN to improve the design of helicopter transmission housings is described. A finite element model of the complete forward rotor transmission housing for the Boeing Vertol CH-47C helicopter was used to study thermal distortion and stress, stress and deflection due to static and dynamic loads, load paths, and design optimization by the control of structural energy distribution. The analytical results are correlated with test data and used to reduce weight and to improve strength, service life, failsafety, and reliability. The techniques presented, although applied herein to helicopter transmissions, are sufficiently general to be applicable to any power transmission system. Author

N77-20504*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASTRAN AS AN ANALYTICAL RESEARCH TOOL FOR COMPOSITE MECHANICS AND COMPOSITE STRUCTURES
C. C. Chamis, J. H. Sinclair, and T. L. Sullivan *In its* NASTRAN: User's Experiences Oct. 1976 p 381-418 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

Selected examples are described in which NASTRAN is used as an analysis research tool for composite mechanics and for composite structural components. The examples were selected to illustrate the importance of using NASTRAN as an analysis tool in this rapidly advancing field. Author

N77-20505*# Watervliet Arsenal, N.Y.
THE QUARTER-POINT QUADRATIC ISOPARAMETRIC ELEMENT AS A SINGULAR ELEMENT FOR CRACK PROBLEMS

M. A. Hussain, W. E. Lorensen, and G. Pflegel *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 419-438 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

The quadratic isoparametric elements which embody the inverse square root singularity are used for calculating the stress intensity factors at tips of cracks. The strain singularity at a point or an edge is obtained in a simple manner by placing the mid-side nodes at quarter points in the vicinity of the crack tip or an edge. These elements are implemented in NASTRAN as dummy elements. The method eliminates the use of special crack tip elements and in addition, these elements satisfy the constant strain and rigid body modes required for convergence. Author

N77-20506*# Old Dominion Univ., Norfolk, Va.
ADDITION OF HIGHER ORDER PLATE ELEMENTS TO NASTRAN
R. Narayanaswami and Chuh Mei (Vought Corp., Hampton, Va.) *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 439-478 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

Two plate elements, the linear strain triangular membrane element CTRIM6 and the higher order plate bending element CTRPLT1, were added to NASTRAN Level 16.0. The theoretical formulation, programming details, and bulk data information pertaining to the addition of these elements are discussed. Sample problems illustrating the use of these elements are presented. Author

N77-20507*# Universal Analytics, Inc., Los Angeles, Calif.
IMPLEMENTATION ON A NONLINEAR CONCRETE CRACKING ALGORITHM IN NASTRAN
David N. Herting, David L. Herendeen, Richard L. Hoesly, and H. Chang (Ebasco Services Inc.) *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 479-494 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

A computer code for the analysis of reinforced concrete structures was developed using NASTRAN as a basis. Nonlinear iteration procedures were developed for obtaining solutions with a wide variety of loading sequences. A direct access file system was used to save results at each load step to restart within the solution module for further analysis. A multi-nested looping capability was implemented to control the iterations and change the loads. The basis for the analysis is a set of mutli-layer plate elements which allow local definition of materials and cracking properties. Author

N77-20508*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME APPLICATIONS OF THE NASTRAN LEVEL 16 SUBSONIC FLUTTER ANALYSIS CAPABILITY
Robert V. Doggett, Jr. and Herbert J. Cunningham *In its* NASTRAN: User's Experiences Oct. 1976 p 495-512 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

The Level 16 flutter analysis capability was applied to an aspect-ratio-6.8 subsonic transport type wing, an aspect-ratio-1.7 arrow wing, and an aspect-ratio-1.3 all movable horizontal tail with a geared elevator. The transport wing and arrow wing results are compared with experimental results obtained in the Langley transonic dynamic tunnel and with other calculated results obtained using subsonic lifting surface (kernel function) unsteady aerodynamic theory. Author

N77-20509*# Sargent and Lundy, Engineers, Chicago, Ill.
MODAL SEISMIC ANALYSIS OF A NUCLEAR POWER PLANT CONTROL PANEL AND COMPARISON WITH SAP 4
M. R. Pamidi and P. R. Pamidi (Computer Sciences Corp., Hampton, Va.) *In* NASA. Ames Res. Center MATRAN: User's Experiences Oct. 1976 p 515-530 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

The application of NASTRAN to seismic analysis by considering the example of a nuclear power plant control panel was considered. A modal analysis of a three-dimensional model of the panel, consisting of beam and quadri-lateral membrane elements, is performed. Using the results of this analysis and a typical response spectrum of an earthquake, the seismic response of the structure is obtained. ALTERs required to the program in order to compute the maximum modal responses as well as the resultant response are given. The results are compared with those obtained by using the SAP IV computer program. Author

N77-20510*# Lockheed-Georgia Co., Marietta.
NASTRAN USED IN A PRODUCTION ENVIRONMENT
R. F. Wilkinson, J. W. Kelley, and N. K. Snead *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 531-554 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

A finite element analysis procedure built around the NASTRAN system is assessed. A number of support programs that were either written or modified to interface with NASTRAN and some improvements that were made to NASTRAN itself are noted. Some typical models are analyzed and an actual schedule is followed for constructing and analyzing the models to support a large design program. Author

N77-20511*# Israel Aircraft Industries Ltd., Lod.
A POSTPROCESSOR SYSTEM FOR THE DATA REDUCTION AND POST ANALYSIS OF NASTRAN RESULTS
A. I. Raibstein, S. Emil, and A. Pipano *In* NASA. Ames Res. Center NASTRAN: User's Experiences Oct. 1976 p 555-580 refs (For primary document see N77-20485 11-39)
Avail: NTIS HC A24/MF A01 CSCL 13M

NASTRAN analysis results are scanned to determine maximum and minimum displacements, forces and stresses. Allowables and margins of safety are computed, and in the case of multiple loading conditions, envelopes for displacements, forces, stresses and margins of safety are also produced for specified element sets. Graphical plots of the reduced or the regular NASTRAN results may be obtained superimposed either of a developed fuselage strip or on a projection of any specified part of the finite element model. The use of the data reduction, post analysis and graphical plotting capabilities provide the analyst with a fast and convenient tool for the study of NASTRAN analysis results and their presentation for project documentation. Author

N77-20512# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soil and Pavements Lab.
BEHAVIORAL CHARACTERISTICS OF GRAVELLY SAND AND CRUSHED LIMESTONE FOR PAVEMENT DESIGN
Final Report
Ed. E. Chisolm and Frank C. Townsend Sep. 1976 69 p refs Sponsored in part by the US Army
(Contract DOT-FA73WAI-377; DA Proj. 4A7-62719-AT-04)
(AD-A033336/9; FAA-RD-75-177) Avail: NTIS HC A04/MF A01 CSCL 13/3

Repeated load triaxial compression tests were conducted to develop and establish laboratory equipment and procedures for determining the resilient properties and rutting potential of cohesionless soils. Materials tested were a crushed limestone and gravelly sand, which were used as base and subbase coarse layers, in prototype pavement test sections. The resilient properties were determined by subjecting single specimens to 100 load repetitions at various stress states whereas the rutting potential was determined by subjecting comparison specimens to up to 100,000 load repetitions of a single stress state. For theta values less than 100 psi, the resilient modulus value was less for the gravelly sand than for the dense crushed limestone. However, for theta values greater than 100 psi, the resilient modulus was nearly identical for both materials. The resilient Poisson's ratio was found to increase as the stress ratio sigma sub 1/sigma sub 3 also increased. The rutting potential of the two materials was about the same at lower stress ratios; however, at higher stress ratios, the rutting potential of the gravelly sand exceeded that of the crushed limestone. The rutting potential of both materials was found to be very small. Author

N77-20513# National Aviation Facilities Experimental Center, Atlantic City, N. J.
FEASIBILITY STUDY OF NOISE-LEVEL REDUCTIONS FOR COMPUTER DISPLAY CHANNEL EQUIPMENT USING

UNDERFLOOR ENVIRONMENT AIR COOLING Final Report, Sep. 1974 - Apr. 1975
John B. Garry Nov. 1976 25 p
(AD-A033053/0; FAA-NA-75-49; FAA-RD-76-155) Avail: NTIS HC A02/MF A01 CSCL 13/1

Removal of equipment cooling fans and the use of existing room air-conditioning for a noise level reduction and as equipment cooling medium are considered. The underfloor cooling air was directed into the cabinets through the area occupied by the fans. The removal of the fans resulted in a noise level reduction within the room. This report evaluates feasibility studies of noise-level reduction through recovery conducted at the Boston Air Route Traffic Control Center (ARTCC). Results show that it is possible to reduce noise levels and to provide a reduction in operating temperature as a result of the flow of the colder underfloor air through the Computer Display Channel (CDC) equipment. Author

N77-20514*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEMINAR ON UNDERSTANDING DIGITAL CONTROL AND ANALYSIS IN VIBRATION TEST SYSTEMS
May 1975 93 p refs Conf. Proc. held at Greenbelt, Md., 17-18 Jun. 1975, and Pasadena, Calif., 22-23 Jul. 1975; partly sponsored by JPL and the Shock and Vibration Information Center
(NASA-TM-X-74637) Avail: NTIS HC A05/MF A01 CSCL 13M

The advantages of the digital methods over the analog vibration methods are demonstrated. The following topics are covered: (1) methods of computer-controlled random vibration and reverberation acoustic testing, (2) methods of computer-controlled sinewave vibration testing, and (3) methods of computer-controlled shock testing. General algorithms are described in the form of block diagrams and flow diagrams. Author

N77-20515# Ecole Polytechnique, Montreal (Quebec). Dept. de Genie Mecanique.
EFFECTS OF INTERNAL AND EXTERNAL FLOW ON THE VIBRATION CHARACTERISTICS OF ANISOTROPIC CYLINDRICAL SHELLS
Aouni A. Lakis Feb. 1977 58 p refs
(EP-77-R-11) Avail: NTIS HC A04/MF A01

A general theory for the dynamic analysis of anisotropic thin cylindrical shells containing turbulent flowing fluid is presented. The shell may be uniform or non-uniform, provided it is geometrically axially symmetric. This is a finite-element theory, using cylindrical finite elements, but the displacement functions are determined by using classical shell theory. A new solution of the wave equation of the liquid finite element leads to an expression of the fluid pressure, p, as a function of the nodal displacements of the element and three operative forces (inertia, centrifugal and Coriolis) of the moving fluid. The random pressure forces are lumped at the nodes of the finite elements. The mean square response of the displacements of the shell are obtained for a boundary-layer pressure field. Some calculations are conducted to illustrate the theory. Author

N77-20516# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Kunststoffe.
AGING OF ADHESIVE METAL JOINTS. PART 1: TORSIONAL VIBRATION TESTS OF ADHESIVE SUBSTANCES AFTER CLIMATE EXPOSURE [ALTERUNG VON METALLKLENVERBINDUNGEN. TEIL 1: TORSIONSSCHWINGUNGSVERSUCHE AN KLEBSTOFFSUBSTANZEN NACH KLIMAEINWIRKUNGEN]
W. Althof and H. Schlothauer 24 Feb. 1975 36 p refs In GERMAN
(DLR-IB-152-75/02-Pt-1) Avail: NTIS HC A03/MF A01

Several adhesives were exposed to climatic conditions for a long period. The changes in the substances were determined by means of torsional vibration tests. This information will be used as a reference in tests with adhesive joints. ESA

N77-20517# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Kunststoffe.
AGING OF ADHESIVE METAL JOINTS. PART 2: SHEAR STRESS - STRAIN RELATIONSHIP OF ADHESIVE FILMS AFTER CLIMATE EXPOSURE [ALTERUNG VON METALLKLEBVERBINDUNGEN. TEIL 2: SCHUBSPANNUNGS-GLEITUNGS-VERHALTEN VON KLEBSCHICHTEN NACH KLIMAEINWIRKUNGEN]
W. Althof, G. Neumann, and G. Klinger 15 Jun. 1975 65 p refs In GERMAN
(DLR-IB-152-75/10-Pt-2) Avail: NTIS HC A04/MF 01

The shear stress-strain relationships of adhesive films in metal joints were investigated to determine effects of climate and time dependence. Results are compared with tests in which only the adhesives were exposed to climate. Conclusions were reached relevant to testing techniques for the evaluation of adhesive aging behavior. ESA

N77-20518# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Kunststoffe.
AGING OF ADHESIVE METAL JOINTS. PART 5: LONG TERM EFFECT OF WARM HUMID CLIMATE ON ADHESIVE FILMS AND ADHESIVE SUBSTANCES [ALTERUNG VON METALLKLEBVERBINDUNGEN. TEIL 5: LANGZEITEINFLUSS VON FEUCHTWARMEM KLIMA AUF KLEBSCHICHTEN UND KLEBSTOFFSUBSTANZEN]
W. Althof, G. Neumann, and H. Schlothauer 1 Jun. 1976 52 p refs In GERMAN
(DLR-IB-152-76/13-PT-5) Avail: NTIS HC A04/MF A01

The aging of eight adhesives used in aircraft construction was investigated in a warm and humid climate. Adhesive films in joints and aged adhesive substances were tested before and after a year of climate exposure. The variation of the shear stress-strain curve with climate was determined for the films and the variation in the shear modulus-temperature curve was determined for the substances using a torsional vibration test. Results are discussed. ESA

N77-20519# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.
NEW TESTING METHODS FOR EVALUATION OF THE AGING STABILITY OF ADHESIVE METAL JOINTS [NEUE VERSUCHSMETHODEN ZUR BEURTEILUNG DER ALTERUNGSBESTAENDIGKEIT VON METALLKLEBVERBINDUNGEN]
W. Althof 16 Aug. 1976 19 p refs In GERMAN
(DLR-IB-152-76/17) Avail: NTIS HC A02/MF A01

As a result of several tests with adhesives used in aircraft construction, it is shown that the testing methods used are suitable for evaluation of the aging stability of an adhesive exposed to climatic conditions. The testing methods are: torsional vibration test of the adhesive substance and determination of the stress-strain ratio of the adhesive in a metal joint. ESA

N77-20520# Defence Research Establishment Ottawa (Ontario).
DECADE PIP ENCODER FOR USE IN INSTRON UNIVERSAL TESTING INSTRUMENTS
Myles R. McMillan Jul. 1976 15 p refs
(AD-A030505; DREO-TN-76-17) Avail: NTIS HC A02/MF A01 CSCL 20/11

The design approach and circuitry of a Decade Pip Encoder for the Instron are described. This encoder superimposes larger pips on the load-elongation curve of a sample under test to indicate 100% elongation of the sample, plus small pips every 10% elongation as presently produced by the Instron Marker Control Option. Author (GRA)

N77-20521# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Weapons Effects Lab.
A METHOD FOR DESIGNING DEEP UNDERGROUND STRUCTURES SUBJECTED TO DYNAMIC LOADS Final Report
James L. Drake and James R. Britt Sep. 1976 50 p refs
(AD-A030601; WES-TR-N-76-9) Avail: NTIS HC A03/MF A01 CSCL 13/13

This report describes solutions to a class of dynamic elastoplastic problems that model some of the salient features

of the response of hardened underground facilities in rock. The theoretical model consisted of multilayered concentric cylinders of elastoplastic materials with time-dependent loads applied to the exterior boundary. Each element in the cross section was assumed to be incompressible and its yield governed by a Mohr-Coulomb failure criterion. The number of elements within the cross section was not limited. Solutions of the theoretical model were cast in the general form normally used in structural dynamics: Mass x Acceleration = External applied load Internal resistance. The resulting equations can be quickly and inexpensively evaluated on a digital computer. To extend the range of validity of the exact theory, a first-order correction factor was developed to account for the compressibility of the materials, and a simple method to treat backpacked structures was introduced. The theory was verified by comparing calculated values with experimental measurements from small-scale static and explosively driven tunnel collapse studies. Good agreement was noted for all cases considered. Author (GRA)

N77-20522# Bureau of Mines, Boulder City, Nev. Metallurgy Research Lab.

DEVELOPMENT AND TESTING OF SUPERIOR SULFUR CONCRETES Report of Investigations 1976

T. A. Sullivan and W. C. McBee Sep. 1976 37 p refs

(PB-259437/2; BM-RI-8160) Avail: NTIS HC A03/MF A01 CSCL 13C

The preparation and testing of sulfur concretes were investigated by the Bureau of Mines as one part of a sulfur utilization program. Modified sulfur concretes were developed by reacting the sulfur with unsaturated hydrocarbons before mixing the molten sulfur and hot aggregate. Physical properties of optimum mixes for both sulfur concrete and modified sulfur concretes, prepared with various aggregates, were determined and compared with Portland cement concretes. The resultant modified sulfur concretes had properties equal to or better than those of unmodified sulfur concrete and Portland cement concrete, depending on the types of aggregate used. GRA

N77-20523# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.

MOISTURE MOVEMENT AND MOISTURE EQUILIBRIA IN PAVEMENT SYSTEMS

Barry J. Dempsey Jun. 1976 150 p refs Sponsored by DOT and Ill. State DOT

(Proj. IHR-604)

(PB-259707/8; UILU-ENG-76-2012; FHWA-RD-76-S0534; Ser-15; Ser-161) Avail: NTIS HC A07/MF A01 CSCL 13B

A satisfactory and realistic procedure for determining moisture movement and moisture equilibria in pavement systems was developed along with procedures for using this information in pavement design. The moisture model was validated, and refined. The model is used to determine how various design modifications influence the moisture regime in a pavement system. It is anticipated that the model and related field and laboratory studies leads to a less empirical approach for incorporating moisture effects into pavement design, construction, behavior, and performance. Author

N77-20524# Transportation Research Board, Washington, D.C.

LIME-FLY ASH-STABILIZED BASES AND SUBBASES Final Report

Oct. 1976 78 p refs Sponsored in part by Federal Highway Admin.

(PB-259732/3; TRB/NCHRP/SYN-37; ISBN-0-309-02510-9) Avail: NTIS HC A05/MF A01 CSCL 13C

The results of a comprehensive review and assessment of current technology for lime-fly ash stabilization of soil materials in bases and subbases are reported. Information is presented on the factors to be considered in mixture design, construction procedures, and determining pavement behavior and performance. Applications and limitations for the use of lime-fly ash aggregate materials for pavement construction are outlined. GRA

N77-20525# Sydney Univ. (Australia). Civil Engineering Labs.

CONCRETE FILLED STEEL TUBULAR COLUMNS

R. Q. Bridge Feb. 1976 43 p

(PB-259617/9; R-283) Avail: NTIS HC A03/MF A01 CSCL 13M

Results are presented of a theoretical and experimental investigation at the University of Sydney into the behavior of pin-ended concrete filled square steel tubes eccentrically loaded to bend about any required axis. The principal variables examined are eccentricity of loading, slenderness and inclination of the loading axis i.e. biaxial bending. The anaysis is shown to accurately predict the observed results. Current design rules for composite columns are examined. A simplified design procedure, using the equivalent pin-ended member approach with moment magnification, is shown to be unconservative for concrete filled tubes. Satisfactory results can be achieved with the use of a reduced estimate for the stiffness of the column and a limitation on the slenderness of the column. GRA

N77-20526# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Aero-Acoustics Branch.

COMPARISON OF THE SONIC FATIGUE CHARACTERISTICS OF FOUR STRUCTURAL DESIGNS Final Report, Jan. 1972 - Dec. 1975

Roelf C. W. VanderHeyde and Nelson D. Wolf Sep. 1976 103 p refs

(AF Proj. 1471)

(AD-A031965; AFFDL-TR-76-66) Avail: NTIS HC A06/MF A01 CSCL 01/3

An experimental program was conducted under which the response and sonic fatigue resistance of four lightweight (1 lb/sq ft) aircraft structural panel types were investigated. Specifically, six sets of 20 aluminum alloy (7075-T 6) panels were tested: one design of skin-stringer, three designs of bonded-beaded, one design of chem-milled, and one design of corrugated panels. Each set of 20 panels was tested in four groups of five panels to obtain results with high statistical confidence levels. The data gathered included panel damping ratios, rms stress, fatigue life and failure types. For some panel types, fatigue data in excess of ten to the eigth power cycles were obtained. A comparison of the sonic fatigue resistance of the four structural designs was made and sonic fatigue design charts for bonded beaded panels developed. Author (GRA)

N77-20527# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.

STRAIN ENERGY EXPRESSIONS OF RINGS OF RECTANGULAR, T- AND I- SECTION, SUITABLE FOR THE DYNAMIC ANALYSIS OF RING-STIFFENED CYLINDRICAL SHELLS

Hans H. Bleich Oct. 1976 44 p refs

(Contract N00014-75-C-0695)

(AD-A031442; TR-51) Avail: NTIS HC A03/MF A01 CSCL 13/13

Strain energy expressions are obtained for rings of rectangular, T- and I- section. The expressions are intended for use in the dynamic analysis of ring stiffened cylindrical shells. The approach is essentially a generalization of the conventional, approximate analysis of straight beams, i.e. the influence of shear stresses, and of direct stresses at right angles to the axis of the beams is neglected. Author (GRA)

N77-20528# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

FRACTURE MECHANICS ANALYSIS OF CENTERED AND OFFSET FASTENER HOLES IN STIFFENED AND UNSTIFFENED PANELS UNDER UNIFORM TENSION Interim Report, Oct. 1974 - Feb. 1975

George Stack Apr. 1976 185 p refs

(Contract F33615-74-C-3063; AF Proj. 1367)

(AD-A032034; ASRL-TR-177-2; AFFDL-TR-75-70) Avail: NTIS HC A09/MF A01

This report documents a finite-element analysis procedure for computation of Mode I and Mode II stress intensity factors associated with one or two sharp cracks emanating from a fastener hole in a panel under uniform tension. The fastener hole may be offset from the panel centerline, and one or both edges of the panel may be integrally stiffened. The formulation of a special assumed-stress hybrid element for the region near the fastener hole is presented. A detailed description of the programming covers the physical problem, modelling, program flow and options, input/output conventions, execution times, and limitations which must be observed. Results are presented

for performance tests of the special element, and for some example analyses of cracked panels. GRA

N77-20529# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
DYNAMIC ANALYSES OF SUSPENSION BRIDGE STRUCTURES Final Report
Ahmed Mansour Abdel-Ghaffer May 1976 372 p refs
(Grant NSF ATA-74-19135)
(PB-258744/2; EERL-76-01) Avail: NTIS HC A16/MF A01 CSCL 13B

A method of dynamic analysis for vertical, torsional and lateral free vibrations of suspension bridges is developed that is based on linearized theory and a finite-element approach. Numerical examples are presented to illustrate the applicability of the analysis and to investigate dynamic characteristics of suspension bridges. The method eliminates the need to solve transcendental frequency equations, simplifies determination of energy stored in the bridge, and represents an accurate tool for calculating natural frequencies and modes by means of a digital computer. The method is illustrated by calculating modes and frequencies of a bridge and comparing them with measured frequencies. GRA

N77-20530# Naval Postgraduate School, Monterey, Calif.
THE IMPLEMENTATION OF A FINITE ELEMENT COMPUTER CODE AND ASSOCIATED PRE- AND POSTPROCESSOR INTO AE4101 AND AE4102 FLIGHT VEHICLE STRUCTURAL ANALYSIS 1 AND 2 M.S. Thesis
Dennis M. Losh Dec. 1976 92 p refs
(AD-A032333) Avail: NTIS HC A05/MF A01 CSCL 09/2

The objectives of the project described in this thesis were to: (1) provide the documentation that is needed for a Naval Postgraduate School student to use the general purpose finite element computer program call SAP 4, and (2) to make available, and prepare the users manual for a pre- and postprocessor program called SUBROUTINE PSAP. This subroutine, which was developed at the NASA Langley Research Center, has been modified to specifically plot the finite element model goemetry for SAP 4 models and to postprocess displacement data for those models on the NPS Calcomp Model 765 Plotter. The input and output for SAP 4 and SUBROUTINE PSAP are discussed in detail. The codes have been used successfully in AE4102, Flight Vehicle Structural Analysis 2. Author (GRA)

N77-20531# National Bureau of Standards, Washington, D.C. Center for Building Technology.
DAYLIGHTING OF BUILDINGS: A COMPENDIUM AND STUDY OF ITS INTRODUCTION AND CONTROL Final Report
John K. Holton Oct. 1976 39 p refs Sponsored in part by the Am. Inst. of Architects
(PB-259523/9; NBSIR-76-1098) Avail: NTIS HC A03/MF A01 CSCL 13A

Significant reductions in the energy consumption of buildings are possible by decreasing the dependence on artificial illumination and decreasing air conditioning loads by employing methods which bring in cool light. In order to design buildings utilizing daylight effectively there must be an understanding of the design principles of daylighting. This requires a knowledge of illumination to meet the needs of the building users, an understanding of characteristics of daylight at the location of the building, and imagination in developing ways to introduce and control daylight. Innovative techniques are identified for the introduction and control of daylight. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N77-20532*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-U.S. STANDARD CATALOG, 1 JANUARY 1977 THROUGH 31 JANUARY 1977
31 Jan. 1977 81 p
(NASA-TM-X-74615; NTISUB/C/139-001; GSF/LN-C/001)
Avail: NTIS HC A05 CSCL 05B

The Non-U.S. Standard Catalog lists Non-U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which was processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover, and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N77-20533*# Mekong Committee Secretariat, Bangkok (Thailand).
AGRICULTURE/FORESTRY HYDROLOGY Quarterly Report, Dec. 1976 - Feb. 1977
W. J. VanderOord, Principal Investigator Mar. 1977 6 p Sponsored by NASA ERTS
(E77-10125; NASA-CR-149872; Rept-6) Avail: NTIS HC A02/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N77-20534*# Colorado School of Mines, Golden. Dept. of Geology.
APPLICATION OF REMOTE SENSOR DATA TO GEOLOGIC ANALYSIS OF THE BONANZA TEST SITE, COLORADO Final Report
Keenan Lee, Principal Investigator Dec. 1976 42 p refs ERTS
(Grant NGL-06-001-015)
(E77-10126; NASA-CR-149873; Rept-76-4) Avail: NTIS HC A03/MF A01 CSCL 08G

The author has identified the following significant results. The Hayden Pass (Orient mine area) includes 60 sq miles of the northern Sangre de Cristo Mountains and San Luis Valley in south-central Colorado. Based on interpretation of the remote sensor data, a geologic map was prepared and compared with a second geologic map, prepared from interpretation of both remote sensor data and field data. Comparison of the two maps gives an indication of the usefulness and reliability of the remote sensor data. The relative utility of color and color infrared photography was tested. The photography was used successfully to locate 75% of all faults in a portion of the geologically complex Bonanza volcanic center and to map and correctly identify 93% of all quaternary deposits and 62% of all areas of tertiary volcanic outcrop. Using a filter wheel photometer, more than 8,600 measurements of band reflectance of several sedimentary rocks were performed. The following conclusions were drawn: (1) the typical spectral reflectance curve shows a gradual increase with increasing wavelength; (2) the average band reflectance is about 0.20; and (3) within a formation, the minimum natural variation is about 0.04, or about 20% of the mean band reflectance.

N77-20535*# Mississippi State Office of Science and Technology, Jackson.
APPLICATION AND EVALUATION OF SATELLITE REMOTE SENSING DATA AND AUTOMATIC PROCESSING TECHNIQUES FOR STATE-WIDE LAND USE AND OTHER RESOURCE MANAGEMENT Progress Report, period ending 21 Oct. 1976
P. T. Bankston, Principal Investigator Oct. 1976 4 p ERTS
(Contract NAS5-20918)
(E77-10127; NASA-CR-149874) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-20536*# Department of Scientific and Industrial Research, Wellington (New Zealand).
DEVELOPMENT OF REMOTE SENSING TECHNOLOGY IN NEW ZEALAND, PART 1. SEISMOTECTONIC, STRUCTURAL, VOLCANOLOGIC AND GEOMORPHIC STUDY OF NEW ZEALAND, PART 2. INDIGENOUS FOREST ASSESSMENT, PART 3. MAPPING LAND USE AND ENVIRONMENTAL STUDIES IN NEW ZEALAND, PART 4. NEW ZEALAND FOREST SERVICE LANDSAT PROJECTS, PART 5. VEGETATION MAP AND LANDFORM MAP OF AUPOURI PENINSULA, NORTHLAND, PART 6. GEOGRAPHICAL APPLICATIONS OF LANDSAT MAPPING, PART 7 Quarterly Report
Mervyn C. Probine, Richard P. Suggate, Michael G. McGreevy, and Ian F. Stirling, Principal Investigators Mar. 1977 134 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10128; NASA-CR-149875; Rept-568-Pt-1; Rept-568-Pt-2; Rept-568-Pt-3; Rept-568-Pt-4; Rept-568-Pt-5; Rept-568-Pt-6; Rept-568-Pt-7; QR-4) Avail: NTIS HC A07/MF A01 CSCL 05B

The author has identified the following significant results. Inspection of pixels obtained from LANDSAT of New Zealand revealed that not only can ships and their wakes be detected, but that information on the size, state of motion, and direction of movement was inferred by calculating the total number of pixels occupied by the vessel and wake, the orientation of these pixels, and the sum of their radiance values above the background level. Computer enhanced images showing the Waimihia State Forest and much of Kaingaroa State Forest on 22 December 1975 were examined. Most major forest categories were distinguished on LANDSAT imagery. However, the LANDSAT imagery seemed to be most useful for updating and checking existing forest maps, rather than making new maps with many forest categories. Snow studies were performed using two basins: Six Mile Creek and Mt. Robert. The differences in radiance levels indicated that a greater areal snow cover in Six Mile Creek Basin with the effect of lower radiance values from vegetation/snow regions. A comparison of the two visible bands (MSS 4 and 5) demonstrate this difference for the two basins.

N77-20537*# Commission of the European Communities, Ispra (Italy).
AGRICULTURAL RESOURCES INVESTIGATIONS IN NORTHERN ITALY AND SOUTHERN FRANCE (AGRESTE PROJECT) Progress Report, 15 May - 31 Dec. 1976
31 Dec. 1976 35 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10129; NASA-CR-149876; PR-4) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. The vegetation structure of rice was investigated and interpreted in dynamic terms as a significant factor governing the distribution of solar energy thoughout the canopy and therefore conditions the final yield. Radiometric characteristics of rice culture were described for various stages of development in relation to the vegetation structure in an attempt to establish correlations between data of total biomass and of grain yield. Qualitative classification results were encouraging although the discrimination achieved was far from complete.

N77-20538*# Corps of Engineers, Waltham, Mass.
THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report, period ending 1 Dec. 1976
Saul Cooper, Principal Investigator 1 Dec. 1976 8 p Sponsored by NASA ERTS
(E77-10130; NASA-CR-149877; PR-7) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-20539*# National Oceanic and Atmospheric Administration, Washington, D.C.
EVALUATION OF LANDSAT-2 DATA FOR SELECTED HYDROLOGIC APPLICATIONS Progress Report
Donald R. Wiesnet and David F. McGinnis, Jr., Principal Investigators 22 Mar. 1977 4 p ERTS
(Contract NAS5-3991)
(E77-10131; NASA-CR-149878) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-20540*# Texas A&M Univ., College Station. Remote Sensing Center.
ANALYSIS OF SYNTHETIC APERTURE RADAR IMAGERY Progress Report, May - Aug. 1976
Bruce J. Blanchard, Principal Investigator 15 Sep. 1976 13 p ERTS
(Contract NAS5-23458)
(E77-10132; NASA-CR-149879; RSC-3359-1) Avail: NTIS HC A02/MF A01 CSCL 20E

The author has identified the following significant results. Average radar response for L-band like polarized system appeared to be related to the watershed runoff coefficients when the viewing angle was approximately 42 deg off nadir. Four requirements for radar systems used to verify applications of active microwave for water resources were identified: (1) first generation digital data will be required; (2) radar should be calibrated both internally and externally; (3) new systems should avoid radom use; and (4) images should be geometrically rectified prior to delivery to the user.

N77-20541*# Brevard County Planning Dept., Titusville, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 12 Aug. - 11 Nov. 1976
John W. Hannah, Garland L. Thomas, and Fernando Esparza, Principal Investigators (NASA. Kennedy Space Center) 11 Nov. 1976 35 p ERTS
(Contract NAS5-20907)
(E77-10133; NASA-CR-149880; BCPD-L2-7) Avail: NTIS HC A03/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-20542*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION AND ENFORCEMENT OF THE PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT Progress Report, 19 Dec. 1976 - 19 Mar. 1977
Orville R. Russell, Principal Investigator 19 Mar. 1977 5 p ERTS
(Contract NAS5-21998)
(E77-10134; NASA-CR-149881; C-1037-2-8) Avail: NTIS HC A02/MF A01 CSCL 08I

There are no author-identified significant results in this report.

N77-20543*# Geological Survey, Malaysia.
GEOLOGICAL AND HYDROGEOLOGICAL INVESTIGATION IN WEST MALAYSIA Quarterly Report
Jaafar Bin Ahmad, Principal Investigator Dec. 1976 10 p Sponsored by NASA ERTS
(E77-10135; NASA-CR-149882; QR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. The broad synoptic view of the images allowed easy identification of circular features and major fault traces in low lying areas. Sedimentary units were delineated in accordance with the prevailing rock types and where applicable the folding characteristics. Igneous units could easily be differentiated by tone, degree of fracturing, texture, and drainage pattern. The larger fold structures, anticlinoriums and synclinoriums, of the younger sediments on the eastern edge of the central belt could also be easily delineated.

N77-20544*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). RESULTS OF LACIE INTEGRATED DROUGHT ANALYSIS (SOUTHERN U.S. GREAT PLAINS DROUGHT 1975-76)
David R. Thompson Jul. 1976 76 p
(NASA-TM-X-74640; LACIE-00424; JSC-11336) Avail: NTIS HC A05/MF A01 CSCL 04A

The development and intensification of the drought in the United States southern Great Plains was monitored during the initial growing period of the 1975-76 winter wheat crop. Because of the severity of the drought conditions, a drought analysis plan was developed and implemented beginning on March 8, 1976. Sample segments and full-frame imagery were used at 9-day intervals to identify the drought area and quantify the effects on the wheat acreage. Yield model simulations were run to extrapolate the effects of the drought on yield estimates at harvest, assuming 10 and 90 percent of normal rainfall for subsequent months and 30-day forecast. A su. ey of LANDSAT data for improvement of distribution of rainfall patterns in the drought area was done for April and yield models run for drought affected crop reporting districts. Special aggregations were performed by the Crop Assessment Subsystem on the drought area to evaluate the utility of remote sensing to monitor the effect of the drought on wheat area, yield, and production. GRA

N77-20545*# Applied Science Associates, Inc., Apex, N.C.
SKYLAB S-193 RADAR ALTIMETER EXPERIMENT ANALYSES AND RESULTS
G. S. Brown, ed. Feb. 1977 382 p refs
(Contract NAS6-2520)
(NASA-CR-2763) Avail: NTIS HC A17/MF A01 CSCL 17I

The design of optimum filtering procedures for geoid recovery is discussed. Statistical error bounds are obtained for pointing angle estimates using average waveform data. A correlation of tracking loop bandwidth with magnitude of pointing error is established. The impact of ocean currents and precipitation on the received power are shown to be measurable effects. For large sea state conditions, measurements of sigma 0 deg indicate a distinct saturation level of about 8 dB. Near-nadir less than 15 deg values of sigma 0 deg are also presented and compared with theoretical models. Examination of Great Salt Lake Desert scattering data leads to rejection of a previously hypothesized specularly reflecting surface. Pulse-to-pulse correlation results are in agreement with quasi-monochromatic optics theoretical predictions and indicate a means for estimating direction of pointing error. Pulse compression techniques for and results of estimating significant waveheight from waveform data are presented and are also shown to be in good agreement with surface truth data. A number of results pertaining to system performance are presented. Author

N77-20546*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FUNDAMENTAL ANALYSIS OF THE LINEAR MULTIPLE REGRESSION TECHNIQUE FOR QUANTIFICATION OF WATER QUALITY PARAMETERS FROM REMOTE SENSING DATA Ph.D. Thesis - Old Dominion Univ.
Charles Henry Whitlock, III May 1977 185 p refs
(NASA-TM-X-74600) Avail: NTIS HC A09/MF A01 CSCL 08H

Constituents with linear radiance gradients with concentration may be quantified from signals which contain nonlinear atmospheric and surface reflection effects for both homogeneous and non-homogeneous water bodies provided accurate data can be obtained and nonlinearities are constant with wavelength. Statistical parameters must be used which give an indication of bias as well as total squared error to insure that an equation with an optimum combination of bands is selected. It is concluded that the effect of error in upwelled radiance measurements is to reduce the accuracy of the least square fitting process and to increase the number of points required to obtain a satisfactory fit. The problem of obtaining a multiple regression equation that is extremely sensitive to error is discussed. Author

N77-20547*# Bendix Corp., Southfield, Mich. Research Labs.
MSS IMAGE DATA STUDY Final Report
W. F. Derouchie 30 Sep. 1976 59 p
(Contract NAS5-22366)
(NASA-CR-152461; BRL-8272) Avail: NTIS HC A04/MF A01 CSCL 22A

A comprehensive mathematical model which includes orbital constraints and high frequency attitude effects was developed, to relate ground and image locations. The parameters of this model were derived from known ground locations of image identifiable points. It should be stressed that the term attitude effect, as used here, includes attitude like effects. The accuracy achieved, using a very dense pattern of control points, is approximately 60 meters rms, for both passes. Author

N77-20548*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCEDURE FOR DETECTION AND MEASUREMENT OF INTERFACES IN REMOTELY ACQUIRED DATA USING A DIGITAL COMPUTER
K. H. Faller Jan. 1976 46 p refs Original contains color illustrations
(NASA-TM-X-74636; ERL-158) Avail: NTIS HC A03/MF A01 CSCL 05B

A technique for the detection and measurement of surface feature interfaces in remotely acquired data was developed and evaluated. A computer implementation of this technique was effected to automatically process classified data derived from various sources such as the LANDSAT multispectral scanner and other scanning sensors. The basic elements of the operational theory of the technique are described, followed by the details of the procedure. An example of an application of the technique to the analysis of tidal shoreline length is given with a breakdown of manpower requirements. Author

N77-20549*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REMOTE SENSING OF CHLOROPHYLL CONCENTRATION: STATE-OF-THE-ART, 1975
B. H. Atwell Jan. 1976 35 p refs
(NASA-TM-X-74635; Rept-156) Avail: NTIS HC A02/MF A01 CSCL 06C

Remote measurement of chlorophyll concentration of the world's oceans from satellite observations could potentially be extremely useful for assessments of productivity in large areas for which measurements by other means would be impractical. The basis of these measurements rests with the physics of the interaction of light with material dissolved and suspended in the water. It is theoretically possible to predict the nature of light upwelled from the ocean surface from a solution to the radiative transfer equation. Practically, however, this is difficult. Monte-Carlo methods presently are thought to be the most viable method to treat the general theoretical problem. With restrictive assumptions of the nature of scattering, it is possible to construct simpler models. Algorithms developed to relate chlorophyll concentration (or some other parameter, i.e., seechi depth) to the upwelled light spectrum are discussed. Author

N77-20550# Oak Ridge National Lab., Tenn. Computer Sciences Div.
CATCH: COMPUTER ASSISTED TOPOGRAPHY, CARTOGRAPHY, AND HYPSOGRAPHY. PART 4: SEESIJ: A SUBROUTINE PACKAGE FOR DETERMINING THE VISIBILITY OF OBJECTS THROUGHOUT A REGION
T. C. Tucker Jun. 1976 47 p refs
(Contract W-7405-eng-26)
(ORNL/TM-3790-Pt-4) Avail: NTIS HC A03/MF A01

For each point on a geographic grid, SEESIJ counts the number of objects in a specified collection which are visible from that point, determines the distance to the nearest object, and finds the maximum weight (importance) associated with a visible object. ERA

N77-20551# Oak Ridge National Lab., Tenn.
REGRID: A GENERALIZED GRID-TO-GRID TRANSFORMATION PROCEDURE
R. G. Mashburn, R. C. Durfee, and R. G. Edwards Jul. 1976 79 p refs
(Contract W-7405-eng-26)
(ORNL-RUS-18) Avail: NTIS HC A05/MF A01

A generalized technique for grid-to-grid transformation was developed for analyzing for digitized geographical data. A variety of data representations are allowed. Although the procedure was developed for problems in environmental and regional analysis, it is also applicable to non-geographic problems such as heat transfer mesh problems. ERA

N77-20552# Bayerische Akademie der Wissenschaften, Munich (West Germany). Bayerische Kommission fuer die Internationale Erdmessung.

ACTIVITIES OF THE SPECIAL RESEARCH GROUP 78 ON SATELLITE GEODESY AT THE MUNICH TECHNICAL UNIVERSITY Annual Report, 1975 [DIE ARBEITEN DES SONDERFORSCHUNGSBEREICHES 78 SATELLITENGEODAESIE DER TECHNISCHEN UNIVERSITAET MUENCHEN IM JAHRE 1975]

Rudolf Sigl 1976 183 p refs In GERMAN
(Astron-Geodaet-Arb-35; ISBN-3-7696-9778-2) Avail: NTIS HC A09/MF A01

Topics covered are acquisition and preparation of satellite observations, as well as complementary terrestrial measurements relating to direction, distance, and position, and the geodetic use of satellite observations and complementary terrestrial measurements. ESA

N77-20553# European Space Agency, Paris (France).

EARTH OBSERVATION FROM SPACE: EUROPE'S INTEREST AND FUTURE PLANS [OBSERVATION DE LA TERRE A PARTIR DE L'ESPACE: INTERET DE L'EUROPE - SES PLANS D'AVENIR]

J. Plevin 1976 19 p refs In FRENCH Presented at the Journees Postuniv. des Ingr. Com., Liege, 27 Mar. 1976
Avail: NTIS HC A02/MF A01

The techniques of remote sensing are surveyed, and the utilization of ecographical satellites is discussed. Details of the European interest in development and utilization of satellite-borne remote sensing techniques are given. The advantages as well as the cost of an ecographical space program are outlined. ESA

N77-20554# Utah State Univ., Logan. Electro-Dynamics Lab.

A SPECULAR CHAMBER FOR OFF-AXIS RESPONSE EVALUATIONS OF HIGH-REJECTION OPTICAL BAFFLING SYSTEM

John C. Kemp and Clair L. Wyatt 1 Jun. 1976 116 p refs (Contract F19628-73-C-0048; DNA Proj. NWET-K11BAXHX534)
(AD-A031212; AFGL-TR-76-0144; Scientific-4) Avail: NTIS HC A06/MF A01 CSCL 14/2

A special chamber for measuring the off-axis response of high-rejection optical baffling systems was designed and constructed. The ambient background power level caused by atmospheric scattering was reduced by using high-efficiency particulate filters to remove the atmospheric aerosols and produce a clean-room environment. The effects of surface scattering were reduced by using specular surfaces in a modified cylindrical shape to direct the scattered radiation away from the baffle entrance. Two computer programs were used to predict the magnitudes of the atmospheric and surface scattering. Measurements which separated the atmospheric scattering from the surface scattering were performed. Rayleigh (molecular) scattering was determined to be the limiting mechanism in achieving a low background. GRA

N77-20555# Rhode Island Univ., Kingston. Dept. of Chemistry.

REMOTE DETECTION OF WATER POLLUTANTS BY COMPUTERIZED LASER-RAMAN SPECTROSCOPY Completion Report, 1 Jul. 1974 - 30 Jun. 1976

Chris W. Brown 30 Jun. 1976 31 p refs Sponsored by Dept. of the Interior
(PB-258777/2; W77-00154; OWRT-A-054-RI(1)) Avail: NTIS HC A03/MF A01 CSCL 07D

Hazardous chemicals in water were analyzed remotely and by conventional instrumentation using a digitized Raman spectrometer. Several data processing methods were explored in order to lower the level of detectability. Furthermore, the feasibility of using the resonance Raman effect to lower the level of detectability was investigated. It is possible to detect many hazardous chemicals in the 1-10 ppm range using either data processing or the resonance Raman effect. GRA

N77-20556# National Geodetic Survey, Rockville, Md.

EFFECT OF GEOCEIVER OBSERVATIONS UPON THE CLASSICAL TRIANGULATION NETWORK

Robert E. Moose and Soren W. Henrikson Jun. 1976 70 p refs
(PB-260921/2; NGS-2; NOAA-TR-NOS-66; NOAA-76092306) Avail: NTIS HC A04/MF A01 CSCL 08B

The use of geoceiver observations as a means of improving triangulation network adjustment results is investigated. Statistics are provided on a sequence of adjustments of this network in which the number of azimuth, base line, and geoceiver observations were systematically varied. From an analysis of this sequence of adjustments, three important conclusions are made. First, the most effective separation for geoceiver observations is about 250 km and greater. Second, there is a limit to the improvement in the a posteriori standard error that geoceiver observations can effect in a triangulation network. Third, geoceiver observations are an effective means of controlling distortions in the local network. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-20557*# Martin Marietta Corp., Denver, Colo.

VIKING LANDER SPACECRAFT BATTERY Final Report

Duane R. Newell Sep. 1976 158 p Prepared for JPL
(Contracts NAS7-100; JPL-649000)
(NASA-CR-152618; MCR-76-321) Avail: NTIS HC A08/MF A01 CSCL 10C

The Viking Lander was the first spacecraft to fly a sterilized nickel-cadmium battery on a mission to explore the surface of a planet. The significant results of the battery development program from its inception through the design, manufacture, and test of the flight batteries which were flown on the two Lander spacecraft are documented. The flight performance during the early phase of the mission is also presented. Author

N77-20558*# Paragon Pacific, Inc., El Segundo, Calif.

COUPLED DYNAMICS ANALYSIS OF WIND ENERGY SYSTEMS Final Report

John A. Hoffman Feb. 1977 86 p refs
(Contract NAS3-19767)
(NASA-CR-135152; PPI-1014-11) Avail: NTIS HC A05/MF A01 CSCL 10A

A qualitative description of all key elements of a complete wind energy system computer analysis code is presented. The analysis system addresses the coupled dynamics characteristics of wind energy systems, including the interactions of the rotor, tower, nacelle, power train, control system, and electrical network. The coupled dynamics are analyzed in both the frequency and time domain to provide the basic motions and loads data required for design, performance verification and operations analysis activities. Elements of the coupled analysis code were used to design and analyze candidate rotor articulation concepts. Fundamental results and conclusions derived from these studies are presented. Author

N77-20559*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.

AN ECONOMIC AND PERFORMANCE DESIGN STUDY OF SOLAR PREHEATERS FOR DOMESTIC HOT WATER HEATERS IN NORTH CAROLINA

Clay B. Jones and Frederick O. Smetana Washington NASA Mar. 1977 32 p refs
(Contract NAS1-14208)
(NASA-CR-2813) Avail: NTIS HC A03/MF A01 CSCL 10A

The performance and estimated material costs for several solar preheaters for domestic hot water heaters using isolation levels present in North Carolina are presented. The effects of

monthly variations in isolation and the direction of incident radiation are included. Demand is assumed at 13 gallons (49.2 liters) per day per person. The study shows that a closed circulation system with 82 gallons (310 liters) of preheated storage and 53.4 cu ft (4.94 cu m) of collector surface with single cover can be expected to cost about $800 and to repay it capital cost and interest (at 8%) in 5.2 years, assuming present electric rates increase at 5% per year. Author

N77-20560*# Meckler (Gershon) Associates, Washington, D. C. Consulting Engineers, Washington, D. C.
APPLICATION OF CHEMICAL DEHUMIDIFICATION SYSTEM TO A ROOF FAN HOUSE AT MICHOUD ASSEMBLY FACILITY AT NEW ORLEANS, LOUISIANA
15 Jul. 1976 38 p ref
(Contract NASw-2920)
(NASA-CR-149888) Avail: NTIS HC A03/MF A01 CSCL 10B

The feasibility of a chemical dehumidification system to reduce the energy consumption associated with dehumidification of the chilled air is assessed. A comparative energy consumption and cost analysis of the chemical dehumidification and existing systems and the savings offered by the proposed chemical dehumidification system over the existing air washer-reheat system are presented. Author

N77-20561*# Meckler (Gershon) Associates, Washington, D. C. Consulting Engineers, Washington, D. C.
APPLICATION OF A RUN AROUND COIL SYSTEM TO A ROOF FAN HOUSE AT MICHOUD ASSEMBLY FACILITY AT NEW ORLEANS, LOUISIANA
15 Jul. 1976 28 p ref
(Contract NASw-2920)
(NASA-CR-149887) Avail: NTIS HC A03/MF A01 CSCL 10B

Analysis of the proposed run around coil system indicates that it offers a decrease in steam, electricity and water consumptions. The run around coil system consist of two coils, a precooling coil which will be located at up stream and a reheating coil which will be located at down stream of the chilled water spray chamber. This system will provide the necessary reheat in summer, spring and fall. At times, if the run around coil system can not provide the necessary reheat, the existing reheat coil could be utilized. Author

N77-20562*# Meckler (Gershon) Associates, Washington, D. C. Consulting Engineers, Washington, D. C.
SUMMARY REPORT OF TECHNICAL DISCUSSION, NASA-ERDA SOLAR ENERGY PROPOSAL
30 Jul. 1976 7 p
(Contract NASw-2920)
Avail: NTIS HC A02/MF A01 CSCL 10A

The impact of the reduced energy requirements and cooling loads of solar collectors is assessed. Energy conservation measures to reduce the energy consumption have been implemented. It is indicated that solar chemical dehumidification was more efficient than solar absorption. Author

N77-20563*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMER PERFORMANCE RESULTS OBTAINED FROM SIMULTANEOUSLY TESTING TEN SOLAR COLLECTORS OUTDOORS
Dean R. Miller Feb. 1977 27 p refs
(NASA-TM-X-73594; E-9066) Avail: NTIS HC A03/MF A01 CSCL 10A

Ten solar collectors were simultaneously tested outdoors. Efficiency data were correlated using a method that separates solar variables (flux, incident angle) from the desired performance parameters (heat loss, absorbtance, transmittance) which are unique to a given collector design. Tests were conducted on both clear and moderately cloudy days. Correlating data in the above manner, a 2-glass, black paint collector exhibited a decrease in efficiency of 5 percentage points relative to the baseline data for an exposure time of 2 years, 4 months. Condensation on the collector glazing was thought to be a contributing factor in this efficiency change. Author

N77-20564*# Old Dominion Univ. Research Foundation, Norfolk, Va.
ANALYSIS OF GaAs AND Si SOLAR ENERGY HYBRID SYSTEMS Final Report
John H. Heinbockel and A. S. Roberts, Jr. Washington NASA Mar. 1977 127 p refs
(Contract NAS1-11707)
(NASA-CR-2800) Avail: NTIS HC A07/MF A01 CSCL 10A

Various silicon hybrid systems are modeled and compared with a gallium arsenide hybrid system. The hybrid systems modeled produce electric power and also thermal power which can be used for heating or air conditioning. Various performance indices are defined and used to compare the system performance: capital cost per electric power out; capital cost per total power out; capital cost per electric power plus mechanical power; annual cost per annual electric energy; and annual cost per annual electric energy plus annual mechanical work. These performance indices indicate that concentrator hybrid systems can be cost effective when compared with present day energy costs. Author

N77-20565*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR ENERGY COLLECTION SYSTEM Patent Application
Charles G. Miller (JPL) and James B. Stephens, inventors (to NASA) (JPL) Filed 25 Jan. 1977 57 p
(Contract NAS7-100)
(NASA-Case-NPO-13579-2; US-Patent-Appl-SN-762362) Avail: NTIS HC A04/MF A01 CSCL 10A

A fixed, linear, ground based primary reflector having an extended curved sawtooth-contoured surface covered with a metalized polymeric reflecting material, reflects solar energy to a movably supported collector that is kept at the concentrated line focus of the reflector primary. The primary reflector may be constructed by a process utilizing well-known freeway paving machinery. The solar energy absorber is preferably a fluid-transporting pipe. Efficient utilization leading to high temperatures from the reflected solar energy is obtained by cylindrical shaped secondary reflectors that direct off-angle energy to the absorber pipe. A seriatim arrangement of cylindrical secondary reflector stages and spot forming reflector stages produces a high temperature solar energy collection system of greater efficiency. NASA

N77-20566*# National Aeronautics and Space Administration. Pasadena Office, Calif.
LOW COST SOLAR ENERGY COLLECTION SYSTEM Patent Application
Charles G. Miller (JPL) and James B. Stephens, inventors (to NASA) (JPL) Filed 25 Jan. 1977 22 p
(Contract NAS7-100)
(NASA-Case-NPO-13579-3; US-Patent-Appl-SN-762363) Avail: NTIS HC A02/MF A01 CSCL 10A

A fixed, linear, ground based primary reflector having an extended curved sawtooth contoured surface covered with a metalized polymeric reflecting material, reflects solar energy to a movably supported collector that is kept at the concentrated line focus of the reflector primary. The primary reflector may be constructed by a process utilizing well known freeway paving machinery. NASA

N77-20567*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ABSORPTION CHARACTERISTICS OF SEVERAL COATINGS AND SURFACE FINISHES
James R. Lowery Washington Mar. 1977 36 p refs
(NASA-TM-X-3509; M-218) Avail: NTIS HC A03/MF A01 CSCL 10A

Solar absorption characteristics are established for several films potentially favorable for use as receiving surfaces in solar energy collectors. Included in the investigation were chemically produced black films, black electrodeposits, and anodized coatings. It was found that black nickel exhibited the best combination of selective optical properties of any of the coatings studied. A serious drawback to black nickel was its high susceptibility to degradation in the presence of high moisture environments. Electroplated black chrome generally exhibited high solar absorptivities, but the emissivity varied considerably and

was also relatively high under some conditions. The black chrome had the greatest moisture resistance of any of the coatings tested. Black oxide coatings on copper and steel substrates showed the best combination of selective optical properties of any of the chemical conversion films studied. Author

N77-20568# General Electric Co., Philadelphia, Pa. Space Div.
GENERAL ELECTRIC COMPANY PROPOSED MANAGEMENT PLAN, COMMERCIAL BUILDINGS, NATIONAL SOLAR DEMONSTRATION PROGRAM
Apr. 1976 123 p
(Contract E(11-1)-2683)
(COO/2683-76/3) Avail: NTIS HC A06/MF A01

The National Solar Demonstration Plan (NSDP) for the solar heating and cooling of non-residential buildings was formulated for a matrix of two hundred (200) commercial demonstration projects. Recommendations for the NSDP pertaining to the management structure, demonstration implementation, schedules, data dissemination, and resources requirements are presented. Closely associated with these major planning elements are the related elements in the other recent General Electric reports submitted under the SHACOB Phase I contract. ERA

N77-20569# General Electric Co., Philadelphia, Pa. Space Div.
GENERAL ELECTRIC COMPANY PROPOSED DEMONSTRATION PROJECTS MATRIX, COMMERCIAL BUILDINGS, NATIONAL SOLAR DEMONSTRATION PROGRAM
Apr. 1976 147 p refs
(Contract E(11-1)-2683)
(COO/2683-76/5) Avail: NTIS HC A07/MF A01

The requirements for selecting commercial demonstrations are derived from the overall goal of the National Program for Solar Heating and Cooling. This goal is to stimulate an industrial and commercial capability for producing and distributing solar heating and cooling (SHAC) systems. The development of the demonstration matrix consists of establishing selection criteria and developing a methodology for applying and evaluating these criteria. The output of this procedure results in a time phased matrix of location SHAC systems, and building types which comprise the recommended National Solar Demonstration projects for commercial buildings. The Demonstration Matrix Definition is comprised of three principle elements: demonstration identification; specific demonstration selection criteria; and architect/engineer selection. ERA

N77-20570# General Electric Co., Philadelphia, Pa. Space Div.
PROPOSED MANAGEMENT PLAN, COMMERCIAL BUILDINGS
Apr. 1976 22 p
(Contract E(11-1)-2683)
(COO/2683-76/8) Avail: NTIS HC A02/MF A01

Recommendations for the National Solar Demonstration Program pertaining to the management structure, demonstration implementation, schedules, data dissemination, and resource requirements are presented. ERA

N77-20571# General Electric Co., Philadelphia, Pa. Space Div.
PROPOSED TEST AND EVALUATION PLAN, COMMERCIAL BUILDINGS
Apr. 1976 20 p
(Contract E(11-1)-2683)
(COO/2683-76/9) Avail: NTIS HC A02/MF A01

The Proposed Test and Evaluation Plan calls for the measurement, collection, and reporting of data from each demonstration site in sufficient detail to evaluate performance of the Solar HVAC system and the associated economic and societal/environmental impacts. Based on the results of systematic trade studies, requirements for an Instrumentation/Data Collection System (IDCS) developed. ERA

N77-20572# General Electric Co., Philadelphia, Pa. Space Div.
PROPOSED DEMONSTRATION PROJECTS MATRIX, COMMERCIAL BUILDINGS
Apr. 1976 16 p
(Contract E(111-1)-2683)
(COO/2683-76/10) Avail: NTIS HC A02/MF A01

Building/location/solar system combinations were selected for the directed level of 200 commercial solar heating and cooling demonstrations. The list of demonstrations was arranged in an effectiveness ranked array. Modeling techniques were applied to the selection process to enable mechanized generation of similar listings at other demonstration levels. Individual demonstration project selection guidelines were developed to provide decision criteria among candidate projects. ERA

N77-20573# Energy Research and Development Administration, Washington, D.C. Div. of Solar Energy.
ERDA SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM STRUCTURE Final Report
15 Apr. 1976 70 p refs
(ERDA-76-81) Avail: NTIS HC A04/MF A01

A total of 600-700 residential and 150-200 commercial demonstrations should be established between 1975-1979. Market penetration stimulated by these demonstrations is forecast to result in an annual solar installation rate approaching 1 percent of new building starts by 1980 and 10 percent by 1985. Annual savings of 0.2 x 10 to the 15th power Btu's of exhaustible energy resources are estimated to accrue by 1985, and 1.4 x 10 to the 15th power Btu's by 2000. The program structure recommended is not complete. An integrated procedure is suggested to enhance confidence in the program structure's definition and to provide an effective tool for planning improvements as the demonstration program proceeds. ERA

N77-20574# Argonne National Lab., Ill.
PREDICTED HEAT-TRANSFER PERFORMANCE OF AN EVACUATED GLASS-JACKETED CPC RECEIVER: COUNTERCURRENT FLOW DESIGN
G. Thodos May 1976 37 p refs
(Contract W-31-109-eng-38)
(ANL-76-67) Avail: NTIS HC A03/MF A01

The heat transfer performance of an evacuated glass-jacketed CPC receiver facility, free on one end and fixed onto the glass jacket at the other, was carried out using heat transfer relationships. Specifically, the collector examined was a 3x-CPC facility, 8 ft long, with an entrance aperture 4.5 in. wide covered with a single glass cover, and provided with an aluminum reflecting surface (rho = 0.88). To maximize heat retention, a selectively treated receiver surface, epsilon = 0.11, was used. The optical efficiency of this CPC collector facility was calculated to be eta = 0.536. ERA

N77-20575# Energy Research and Development Administration, Washington, D.C.
SOLAR ENERGY, DFVLR ACTIVITIES
11 Feb. 1976 8 p Transl. into ENGLISH of a German report
(ERDA-TR-143) Avail: NTIS HC A02/MF A01

The research programs of the DFVLR in the area of utilization of solar energy are briefly summarized in terms of systems with focusing collectors, systems with flat collectors, and wind turbines. ERA

N77-20576# Boeing Co., Seattle, Wash.
CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM, COLLECTOR SUBSYSTEM Quarterly Technical Progress Report
31 Dec. 1975 90 p refs
(Contract E(04-3)-1111)
(SAN-1111-75-1) Avail: NTIS HC A05/MF A01

The preliminary design baseline collector sybsystem for a 10 MW/sub e/solar thermal pilot plant was documented. Supporting data and analyses used in selecting the specific design, and results of research experiments in progress to verify the design are included. Each reflector in the collector subsystem is enclosed within a 7 meter diameters, air supported Tedlar dome. Tedlar for the baseline dome will be 0.15 mm thick and will be specially processed to obtain a smooth surface which will provide high specular (direct) transmittance (86 to 90 percent). The reflector utilizes a commercially-available 0.05 mm thick Mylar film which is coated with vacuum-deposited aluminum on one surface. The drive and control system selected for the heliostats

is a computer-controlled openloop system utilizing incremental position feedback from optical encoders on each heliostat drive. Author (ERA)

N77-20577# Applied Nucleonics Co., Inc., Los Angeles, Calif.
PROCEEDINGS OF AN EPRI WORKSHOP ON TECHNOLOGIES FOR CONSERVATION AND EFFICIENT USE OF ELECTRIC ENERGY. VOLUME 1: OVERVIEW
Fritz Kalhammer Jul. 1976 44 p refs Conf. held at San Diego, Calif., 26-30 Jul. 1976 Sponsored by Elec. Power Research Inst.
(PB-261469/1; EPRI-EM-313-SR-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 10A

Economic analysis of energy demand and conservation is discussed with special attention to the solar heating and cooling of buildings. I.M.

N77-20578# Argonne National Lab., Ill.
APPLICATIONS AND PROSPECT OF ENERGY STORAGE BATTERIES
N. P. Yao 1976 4 p Presented at the IEEE Region 6 Conf., Tucson, Ariz., 7-9 Apr. 1976
(Contract W-31-109-eng-38)
(CONF-760416-2) Avail: NTIS HC A02/MF A01

The major incentive for the U.S. to develop commercial-scale batteries and other efficient storage systems is the potential saving of petroleum and natural gas. Storing the off-peak energy derived from coal and nuclear base generating plants and discharging it during the periods of high demand is the concept contemplated for electric utility application. Wide use of electric vehicles in big cities and urban areas for the improvement of air quality is another incentive. Three key areas are discussed: the technical and economic requirements of batteries for applications to electric utility and to electric vehicles, the current development status of battery technology in the U.S. and the level of development efforts, and the prospects and the schedule for implementing the advanced battery technology.ERA

N77-20579# Argonne National Lab., Ill.
BATTERIES FOR UTILITY LOAD LEVELING
P. A. Nelson and N. P. Yao 1976 22 p refs Presented at Am. Power Conf., Chicago, 20-22 Apr. 1976
(Contract W-31-109-eng-38)
(CONF-760469-3) Avail: NTIS HC A02/MF A01

A critical need for conservation is to reduce the use of dwindling oil and gas resources in electric energy generation. Leveling or peak shaving electric utility loads by means of off-peak energy storage devices would allow an orderly shift to increased utilization of base-load energy, and thereby decrease the use of oil and gas by turbine generators. The concept of energy storage by batteries is particularly attractive for electric utility applications. Areas discussed include: the technical and economic requirements of batteries for applications to electric utilities, the near-term technology for the lead-acid battery and the prospect for its use in utility applications, and the development status and the incentives for developing advanced battery technology. The Battery Energy Storage Test Facility is also briefly discussed; it will provide a test bed for advanced batteries in a utility network. ERA

N77-20580# Oak Ridge National Lab., Tenn. Energy Div.
ENGINEERING-ECONOMIC MODEL OF RESIDENTIAL ENERGY USE
E. Hirst, W. Lin, and J. Cope Jul. 1976 57 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5470) Avail: NTIS HC A04/MF A01

A comprehensive engineering-economic computer model used to simulate energy use in the residential sector from 1970 to 2000 is described. The model is to provide an analytical tool with which to evaluate a variety of conservation policies, technologies, and stragegies for their impacts on residential energy use and fuel expenditures over time. The present version of the model deals with energy use at the national level for four fuels; six end uses and three housing types. Each of these fuel uses is determined for each year of the simulation as the product of: stock of occupied housing units, fraction of homes using each fuel for each end use, average annual energy requirement for each type of equipment, average thermal integrity for each housing type, and household usage behavior for each fuel and end use. Simulations of energy use from 1960 to 1974 show that the model does an excellent job of forecasting historical fuel use data in aggregate, by fuel, and by end use. ERA

N77-20581# Oak Ridge National Lab., Tenn.
MIUS SYSTEM ANALYSIS: COMPARISON OF MIUS AND CONVENTIONAL UTILITY SYSTEMS FOR AN EXISTING DEVELOPMENT
E. L. Hise, W. J. Boegly, Jr., J. O. Kolb, J. T. Meador, W. R. Mixon, G. Samuels, C. L. Segaser, and J. V. Wilson Jun. 1976 178 p refs
(Contract W-7405-eng-26)
(ORNL-HUD-MIUS-20) Avail: NTIS HC A09/MF A01

Application of the Modular Integrated Utility System (MIUS) concept to an existing housing-commercial development (Walden) that is located near Chicago, Illinois, is evaluated. Comparisons of fuel savings, annual costs, and environmental impacts between the MIUS and conventional utility services to the development have been performed. In the Live Model, even though the source of electricity was small (engine-generators having an operating efficiency averaging about 30 percent), the overall fuel utilization was about 62 percent. The overall efficiency of fuel utilization for the conventional utility was only 51 percent. Environmental impacts of the Live Model are an increase in CO, HC, and NO/sub x/ emissions, but a reduction in SO2 and particulate emissions. Impact due to onsite liquid waste treatment is mainly caused by releasing effluent at a different point than a large conventional system since the same, or higher, degree of treatment can be obtained with small plants as can be produced with larger plants. ERA

N77-20582# Pittsburgh Univ., Pa. Dept. of Chemistry.
THERMAL, STRUCTURAL, AND MAGNETIC STUDIES OF METALS AND INTERMATALLIC COMPOUNDS Final Report
W. E. Wallace, R. S. Craig, and V. U. S. Rao 15 Aug. 1976 28 p refs
(Contract E(11-1)-3429)
(COO-3429-27) Avail: NTIS HC A03/MF A01

The powerful magnetism of certain intermetallics, e.g., SmCo5, was established to originate with the powerful magnetic anisotropy of SmCo5, not its large magnetization. The anisotropy is, in turn, a crystal field effect. The crystal field interaction was elucidated by the method of quantum mechanics. Studies of the systems RFe2, RFe3, RCo3, and R2Co7 (R = a rare earth, Y or Th) reveal them to be important for hydrogen storage. In addition, important effects associated with hydrogenation of metals were found-great enhancement of magnetization of certain systems (e.g., ErFe2) and substantial increase in superconducting transition temperatures (e.g., Zr/sub .5/H/sub .5/V2). Results of studies suggest that the surfaces of rare earth intermetallics are typical. The spectrum of properties exhibited by the rare earth intermetallics suggests their utility in the efficient capture and storage of solar energy and the use of it for powering a vehicle. ERA

N77-20583# Brookhaven National Lab., Upton, N.Y.
THE 1985 TECHNICAL COEFFICIENTS FOR INPUTS TO ENERGY TECHNOLOGIES
J. Lukachinski and R. G. Tessmer, Jr. Jun. 1976 38 p refs
(Contract E(30-1)-16)
(BNL-50532) Avail: NTIS HC A03/MF A01

Input-output technical coefficients estimated for five new energy supply and conversion technologies were incorporated into a 110-sector Energy I-O Model. The technologies are solvent refining of coal, oil shale mining and retorting, high temperature gas cooled reactor electricity generation, high BTU coal gasification, and COGAS combined-cycle electricity generation. Incorporation of seven existing energy supply and conversion technologies is also described: crude oil and gas extraction, coal mining, refined petroleum products, pipeline gas, fossil electric generation, and hydroelectric generation. Non-energy input coefficients are given in units of 1967 $/million BTU and represent the inputs in constant 1967 dollars from non-energy sectors (e.g. manufacturing, transportation, services) required per million BTU of energy production by each of these energy supply technologies. The 90 non-energy sectors included are based on

the Bureau of Economic Analysis 83 sector input-output structure for 1967 with minor disaggregations. Energy input coefficients are given in units of BTU/BTU. ERA

N77-20584# Kernforschungsanlage, Juelich (West Germany).
CONFERENCE ON ENERGY MODELS FOR THE FEDERAL REPUBLIC OF GERMANY
Apr. 1975 272 p refs Partly in GERMAN and ENGLISH Conf. held at Julich, West Germany, 30-31 Jan. 1975
(JUL-Conf-15; Conf-750139) Avail: NTIS (US Sales Only) HC A12/MF A01; ERDA Depository Libraries

In order to guarantee sufficient energy supplies for the future, energy planners involved in both government and economic affairs have to deal with the problem of estimating the consequences of new technologies on the change of the energy-political situation. The aims of this workshop were to show the actual situation of the development of energy models for the whole energy system to formulate the requirements of energy models from the point of view of energy planners in government and industry; to promote the exchange of experiences among the individual groups that deal with the preparation of energy models; and to discuss methods problems. ERA

N77-20585# Carnegie-Mellon Univ., Pittsburgh, Pa
DESIGN AND MODELING OF SOLAR SEA POWER PLANTS BY GEOMETRIC PROGRAMMING
C. C. Wu Apr. 1976 157 p refs
(Contract E(11-1)-2895; Grant NSF GI-39114)
(COO/2895-T1) Avail: NTIS HC A08/MF A01

Geometric programming, a nonlinear optimization technique, is used to design Solar Sea Power Plants (SSPP). The conversion process is described, and the hardware necessary to implement a binary-fluid, closed-Rankine cycle is identified. Steady-state analytical models for the major components are derived. These models are then used as the constraints of a geometric program whose objective function is the minimization of a particular function of the design variables of the SSPP. A variety of problems are solved. On one extreme, they include simply the design of a minimum surface heat exchanger for a SSPP, and on another extreme the selection of the various water pipes for a given ocean site, accounting for all the hydraulic losses. ERA

N77-20586# Oak Ridge National Lab., Tenn.
MODELING RESIDENTIAL ENERGY USE
Eric Hirst, William Lin, and Jane Cope 1976 5 p refs Presented at 11th Intersoc. Energy Conversion Eng. Conf., Lake Tahoe, Calif., 9 Sep. 1976 Sponsored in part by FEA
(Contract W-7405-eng-26)
(CONF-760904-1) Avail: NTIS HC A02/MF A01

A comprehensive engineering-economic computer model used to simulate energy use in the residential sector is described. The purpose of the model is to provide an analytical tool with which to evaluate a variety of conservation policies, technologies, and strategies for their impacts on residential energy use and fuel expenditures over time. The present version of the model deals with energy use at the national level for four fuels, six end uses, and three housing types. ERA

N77-20587# Brookhaven National Lab., Upton, N.Y.
ROLE OF REGIONAL ANALYSIS IN THE FORMULATION OF ENERGY POLICY: THE CASE OF THE NORTHEAST
P. F. Palmedo, J. Brainard, H. Davitian, and R. Goettle, IV 1976 26 p refs Presented at NSF Workshop on Long-run Energy Demands, McLean, Va., 9 Jun. 1976
(Contract E(30-1)-16)
(BNL-21555; Conf-760648-2) Avail: NTIS HC A03/MF A01

Policies and strategies affecting energy conservation are considered. Drawing on a recent study of alternative energy futures for the Northeast, some of the factors that are involved in a regional view of energy conservation as a concerted policy are examined. ERA

N77-20588# Argonne National Lab., Ill.
TRANSPORTATION ENERGY CONSERVATION: TOOLS TO MEET THE NATIONAL OBJECTIVE
S. J LaBelle, ed. Mar. 1976 43 p Conf. held at Argonne, Ill., 12 Feb. 1976
(Contract W-31-109-eng-38)
(ANL-76-XX-4; Conf-760226-1) Avail: NTIS HC A03/MF A01

From the discussions it was concluded that: (1) energy conservation can be achieved in transportation systems through the implementation of system operation and technological strategies; (2) the Federal government should play a vital role in achieving energy conservation by strengthening its position as a central information source, a clearinghouse for state and local governments, industry, and private citizens; (3) the potential for energy savings in transportation system operation and management, demand shifts, and reductions must not be overlooked; (4) modeling can be a useful tool in both research program management and forecasting the effects of implementing a particular strategy for energy conservation; (5) the evaluation and selection process for technology R and D must include commercialization studies along with the technological indicators of program success; and (6) Federal agencies need to coordinate their own activities in this area. ERA

N77-20589# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.
METAL HYDRIDES AS HYDROGEN STORAGE MEDIA AND THEIR APPLICATIONS
J. J. Reilly 14 Jul. 1976 88 p refs
(Contract E(30-1)-16)
(BNL-21648) Avail: NTIS HC A05/MF A01

The four hydride systems of current interest for hydrogen storage applications are the hydrides of magnesium and certain of its alloys, iron titanium alloys, vanadium, and lanthanum pentanickel (or AB5) type alloys. Peak shaving, automotive, thermal storage and solar energy, and pumps and compressors are some of the areas of application. ERA

N77-20590# California Univ., Livermore. Lawrence Livermore Lab.
SOLAR ENERGY: L-DIVISION MISCELLANEA
R. D. Neifert 27 May 1976 11 p refs
(Contract W-7405-eng-48)
(UCID-17177) Avail: NTIS HC A02/MF A01

The capabilities that were developed within L-Division related to the use of solar energy for heating of buildings, electrical generation, and/or process heat are summarized. These capabilities primarily directed towards studies related to the Sohio Process Heat Facility project. A stand-alone data acquisition system was developed to measure instantaneous solar radiation and ambient air temperature. A compact, mobile calibration system is available to cross-calibrate solar instruments in-situ. Solar radiation data was collected and analyzed since January 1974. Several computer codes are available for parametric performance studies of process heat facilities and calculating collection efficiency for a shallow solar pond. ERA

N77-20591# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CENTRAL RECEIVER SOLAR THERMAL SYSTEM, PHASE 1, CPRL ITEM 10 Quarterly Progress Report
R. W. Hallet, Jr. and R. L. Gervais Apr. 1976 83 p
(Contract E(04-3)-1108)
(SAN-1108-76-2; MDC-G6382; QTPR-2) Avail: NTIS HC A05/MF A01

The dominant activities during the reporting period have involved the detailed definition of the subsystem research experiments and the design of the test articles and test facilities. Summaries of these activities are presented. Design changes to the 10-MWe pilot plant preliminary design baseline which occurred during the report period are also described. ERA

N77-20592# California Univ., Livermore. Lawrence Livermore Lab.
SOLAR INDUSTRIAL STEAM
A. F. Clark and M. F. Merriam 9 Jul. 1976 7 p refs Presented at Sharing the Sun: Solar Technol. in the Seventies, Winnipeg, Can., 15 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-77895) Avail: NTIS HC A02/MF A01

An inexpensive low concentration reflector was discussed: a cylinder of inflated plastic film, transparent on top and reflecting on the bottom; a black pipe containing water (and steam) is placed at the focal line. ERA

N77-20593# Argonne National Lab., Ill.
FUEL CELL BENEFIT ANALYSIS
Samuel H. Nelson and John P. Ackerman Jun. 1976 41 p refs
(Contract W-31-109-eng-38)
(ANL/ES-51) Avail: NTIS HC A03/MF A01

The potential benefits resulting from the commercialization of first-generation fuel cells in the early 1980s were studied. Utilization of fuel cells was assessed for electric generation, integrated energy systems, combined production of electricity and industrial process steam, and export markets. The electric utility market was further divided into new capacity for privately-owned utilities, rural electric cooperatives, and for replacement of obsolete units. In addition, the effect of a different growth rate for electricity demand was evaluated. On the basis of these evaluations, it was found that there would be substantial savings of energy and money, as well as substantial increases in exports, if first-generation fuel cells were brought to market in the early 1980s. ERA

N77-20594# Brookhaven National Lab., Upton, N.Y.
TECHNICAL AND ECONOMIC ASPECTS OF POTENTIAL US DISTRICT HEATING SYSTEMS
J. Karkheck, E. Beardsworth, and J. Powell Apr. 1976 21 p refs Presented at 11th Intersoc. Energy Conversion Eng. Conf., State Line, Nev., 12 Sep. 1976
(Contract E(30-1)-16)
(BNL-21287; Conf-760906-7) Avail: NTIS HC A02/MF A01

District heating stands as a means to conserve fossil fuel through more efficient utilization of these resources as a primary source of heat because it can supplant the application of fossil fuels to a great extent by utilizing waste heat from various sources. Of paramount interest as a source of waste heat are the steam electric generating plants, especially those powered by nuclear fission. Utilization of this by-product allows immediate cutback in fossil fuel consumption. It relieves the environment from bearing the burden of huge amounts of excess heat. It opens the supply of fossil fuels to more complex applications where these are used to greater advantage. It raises the energy conversion efficiency of these electric plants considerably and is economical. An analysis of a study of nine urban regions that collectively display a wide variation in the parameters that are the primary determinants of unit heat cost is presented.
(Author) ERA

N77-20595# Sandia Labs., Albuquerque, N.Mex.
STORAGE AND DISCHARGE TESTS OF LITHIUM-ORGANIC ELECTROLYTE CELLS
S. C. Levy Mar. 1976 29 p refs
(Contract AT(29-1)-789)
(SAND-75-0645) Avail: NTIS HC A03/MF A01

Information is provided on the effects of storage time and temperature, and discharge rate and temperature on the performance of lithium-vanadium pentoxide organic electrolyte cells. ERA

N77-20596# Los Alamos Scientific Lab., N.Mex.
THERMODYNAMICS AND TRANSPORT OF GASEOUS IRIDIUM OXIDES IN MULTI-HUNDRED-WATT THERMOELECTRIC GENERATORS
Dean E. Peterson May 1976 9 p refs
(Contract W-7405-eng-36)
(LA-6352) Avail: NTIS HC A02/MF A01

Thermodynamic properties of the iridium oxide system were determined by using a mass spectrometer and target collection apparatus with a gas inlet system. Iridium dioxide and trioxide were identified as the predominant gaseous oxides in equilibrium with iridium metal in an oxygen atmosphere of .0001 to .01 atm at 1600-1800 C. The analyses idicated that iridium transport due to iridium oxidation by the plutonia fuel is negligible at the fuel operating temperature, but that the fuel oxygen can participate in iridium transport at higher temperatures such as occur during reentry or a launch pad fire. The effect of an iridium dioxide impurity layer on the iridium transport also is discussed. ERA

N77-20597# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN OPTIMIZATION OF BETA AND PHOTOVOLTAIC CONVERSION DEVICES
R. Wichner, A. Blum, E. Fischer-Colbrie, and H. Chau 8 Jan. 1976 55 p refs
(Contract W-7405-eng-48)
(UCRL-51993) Avail: NTIS HC A04/MF A01

To meet the objective, a comprehensive computer code has been developed that can handle a broad range of practical conditions. The physical model upon which the code is based is described first. Then, an example is given of a set of optimization calculations along with the resulting optimized efficiencies for silicon (Si) and gallium-arsenide (GaAs) devices. The model we have developed, however, is not limited to these materials. It can handle any appropriate material-single or polycrystalline-provided energy absorption and electron-transport data are available. ERA

N77-20598# California Univ., Livermore. Lawrence Livermore Lab.
SIMPLE HOME HEATING SYSTEM (WHAT CAN BE DONE NOW)
George E. Bush 7 Jul. 1976 5 p refs Presented at Sharing the Sun, Solar Technology in the Seventies, Winnipeg, Canada, 15-20 Aug. 1976; sponsored by the Intern. Solar Energy Soc.
(Contract W-7405-eng-48)
(UCRL-77875; Conf-760821-5) Avail: NTIS HC A02/MF A01

A solar heating system was designed and built as a retrofit on an existing 1,500 square-foot (139 square meter) tract home. The system and the results of the first heating season are reported. Some comments on difficulties encountered during construction and suggestions for future research are offered. The collector is of the water trickle type, with one glazing, and 400 square-feet area. The entire design stresses low temperature operation to minimize fabrication costs. The heat storage is 1,000 gallons of water, and the design was for 53 percent solar heating over the entire year. A brief analysis of this difference between design and measured performance is presented. ERA

N77-20599# Virginia Univ., Charlottesville.
PERFORMANCE AND ANALYSIS OF SOLARIS WATER-TRICKLE SOLAR COLLECTOR
J. T. Beard, F. L. Huckstep, W. B. May, Jr., F. A. Iachetta, and L. U. Lilleleht 1976 18 p refs Presented at Sharing the Sun: Solar Technol. in the Seventies, Winnipeg, Can., 15 Aug. 1976
(Contract E(40-1)-4927)
(CONF-760821-9) Avail: NTIS HC A02/MF A01

An outdoor solar collector test facility was designed and constructed for performance evaluation of Thomason SOLARIS water-trickle solar collector panels. Two full size 1.2m x 4.9m) collector panels are tested simultaneously on each of two test stands, so that various design and operational variables are evaluated under the same ambient conditions. Results are presented to illustrate performance and comparisons relative to published results of other single and double glazed flat plate collectors. A method is developed for using performance results for design applications. Calculations illustrating the method are shown for Washington, D.C. ERA

N77-20600# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
THEORY OF STRUCTURE AND DYNAMICS IN CONDENSED MATTER AND APPLICATIONS IN GEOPHYSICS AND SOLAR ENERGY Progress Report, 1 Apr. 1975 - 31 Mar. 1976
J. A. Krumhansl Mar. 1976 9 p
(Contract E(11-1)-3161)
(COO-3161-40) Avail: NTIS HC A02/MF A01

The properties of rocks and the design of composite photothermal conversion surfaces were tested. The major topics discussed are: (1) Theory of structural phase transitions; (2) Theory of interatomic interactions, with application to defect structures and surface complexes; and (3) Application of the theory of disordered (heterogeneous) materials to the elastic properties of rocks, commercial graphite, and composite solar energy absorbing materials. (Author) ERA

N77-20601# California Univ., Livermore. Lawrence Livermore Lab.
SHALLOW SOLAR PONDS FOR INDUSTRIAL PROCESS HEAT: THE ERDA-SOHIO PROJECT
W. C. Dickinson, A. F. Clark, and A. Iantuono 17 Jun. 1976 26 p refs Presented at Sharing the Sun, Solar Technology in the Seventies, Winnipeg, Canada, 15-20 Aug. 1976; sponsored by the Intern. Solar Energy Soc.
(Contract W-7405-eng-48)
(UCRL-78288) Avail: NTIS HC A03/MF A01

Shallow solar ponds were developed to supply cost-competitive solar heated water for industrial use. A prototype system has been built and put into operation at the site of the Sohio Petroleum Company's new uranium mine and milling complex near Grants, New Mexico. When operational, a projected full-size system is expected to furnish approximately half of the annual site process heat requirement. A description of the physical features of shallow solar ponds is presented along with a method for analyzing pond performance. An economic analysis of the projected Sohio solar system is provided. ERA

N77-20602# Sandia Labs., Albuquerque, N.Mex. Heat Transfer and Fluid Mechanics Div.
HEAT EXTRACTION FROM A MAGMA RESERVOIR
Dec. 1974 20 p refs
(Contract AT(29-1)-789)
(SAND-74-0329) Avail: NTIS HC A02/MF A01

Approximate heat extraction rates from basaltic magma chamber are shown to range from a pessimistic 1 kW/sq m to an optimistic value of 175 kW/sq m. The particular value depends strongly on the assumptions made concerning the thermal properties and size of the magma chamber. Preliminary calculations indicate that the lower value for heat extraction rate probably applies to magma chambers that might exist in regions not volcanically active in recent times. ERA

N77-20603# General Electric Co., Philadelphia, Pa. Space Div.
TECHNOLOGY EVALUATION REPORT, COMMERCIAL BUILDINGS
Apr. 1976 192 p refs
(Contract E(11-1)-2683)
(COO-2683-76-1) Avail: NTIS HC A09/MF A01

Criteria are presented which are to be met by solar hardware for inclusion in the demonstration program. Assessments are made, based on a survey made of solar hardware manufacturers and developers, of when components, subsystems, and systems will be available for demonstration according to the technology status categories. Task outlines are provided for development activity recommended to improve available systems or develop advanced systems for later demonstration cycles. ERA

N77-20604# Svenska Flacktfabriken AB, Stockholm (Sweden).
ENERGY REDUCTION IN EUROPE
R. Olsson 29 Apr. 1976 6 p In GERMAN Presented at the EXPOCLIMA Congress Energy Savings in Climate and Cooling Technology, Hanover, West Germany, 29 Apr. 1976
(CONF-760463-1) Avail: ERDA Depository Libraries

Energy consumption for the heating and ventilation of buildings is discussed, and measures taken in Sweden and West Germany to conserve energy in residential, commercial, and industrial buildings are described. ERA

N77-20605# Brookhaven National Lab., Upton, N.Y.
INSTRUMENTATION REQUIREMENTS FOR LONG SUPER-CONDUCTING POWER TRANSMISSION LINES
J. E. Jensen 1976 9 p refs Presented at Instr. Soc. of Am. Intern. Conf. and Exhibit, Houston, Tex., 10-14 Oct. 1976
(Contract E(30-1)-16)
(BNL-21666; Conf-761007-4) Avail: NTIS HC A02/MF A01

Two studies of possible applications of long superconducting power transmission lines are presented to illustrate instrumentation requirements and attendant problems. These studies serve to show the types of equipment, logistics, and environmental factors affecting the instrumentation. The parameters requiring measurement are discussed along with indications of how the data acquired will be used in control, diagnostics, and safety of the cryoelectric system. ERA

N77-20606# Brookhaven National Lab., Upton, N.Y.
TECHNICAL AND ECONOMIC FEASIBILITY OF US DISTRICT HEATING SYSTEMS USING WASTE HEAT FROM FUSION REACTORS
J. Karkheck, E. Beardsworth, and J. Powell Feb. 1976 156 p refs
(Contract E(30-1)-16)
(BNL-50516; TID-4500) Avail: NTIS HC A08/MF A01

District heating systems were shown to be economically attractive for large scale implementation in the U.S., provided suitable sources of waste heat, such as fusion reactors are available. Since fusion reactors appear to be more environmentally acceptable than fission reactors or coal steam electric plants, they could possibly be located closer to district heat load centers, which should result in substantial cost savings. Distances on the order of 20 miles from urban areas are acceptable in terms of transmission cost. Model district heating systems were designed for nine regions in the U.S. (New York City, Paterson, N.J., Chicago, Philadelphia, Los Angeles, Baton Rouge, New Orleans, Jersey City, and Newark). The implementation and costs to be expected for district heating systems in the U.S. as a whole were also estimated. The impact of the CRT-district heat option on the U.S. energy system was evaluated. It was concluded that two additional markets exist for district heating, those of process heat and air conditioning. ERA

N77-20607# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
THE CYLINDRICAL PARABOLIC MIRROR AS REFLECTOR FOR SOLAR COLLECTORS. EFFICIENCIES AND OPTIMIZATION
Rainer Koehne 27 Oct. 1976 36 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-365)
(DLR-FB-76-55) Avail: NTIS HC A03/MF A01 DFVLR, Cologne DM 15,90

After introducing the concentration ratio and intercept factor of focusing collectors with parabolic cylinder mirrors, the energy balance equations were derived to determine the efficiencies under steady state conditions. The components of the collector were varied and optimized with respect to maximum efficiency. The dynamic behavior of the collector was calculated and the average efficiencies compared with the efficiencies in the steady state condition. Author (ESA)

N77-20608# Engelhard Minerals and Chemicals Corp., Union, N. J.
EPA VAN OPERATIONAL MANUAL
Niels E. Scholer Aug. 1976 64 p
(Contract EPA-68-02-1482)
(PB-259177/4; EPA-600/9-76-020) Avail: NTIS HC A04/MF A01 CSCL 13A

The manual generally describes the EPA Van, and discusses both its energy control system and Van operation. The manual includes instructions for the Van's transportation, setup, safety, troubleshooting, and maintenance. The Van is a mobile research unit, designed for testing in various parts of the United States. Its unique energy supply system includes fuel cells, a solar energy collector, a heat pump, and catalytic appliances. An energy control system optimizes the energy consumed by the integrated system. GRA

N77-20609# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
SELECTING HYDRAULIC REACTION TURBINES
Richard N. Walters and Carlos G. Bates Oct. 1976 57 p Revised
(PB-259722/7; Engineering Monograph-20) Avail: NTIS HC A04/MF A01 CSCL 10B

The revised monograph reflects modern trends in the selection of hydraulic reaction turbines. Figures are included which show characteristics of the turbine in relation to various parameters for estimating size and predicting performance of the unit. GRA

N77-20610# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
CLEAN FUELS FROM AGRICULTURAL AND FORESTRY

WASTES Final Report, Jun. 1974 - Mar. 1975
J. W. Tatom and A. R. Colcord Apr. 1976 118 p refs
(Contract EPA-68-02-1485)
(PB-259956/1; EPA-600/2-76-090) Avail: NTIS HC A06/MF A01 CSCL 13B

The operating parameters for a mobile waste conversion system based on the Georgia Tech Engineering Experiment Station's partial oxidation pyrolysis process was investigated. The combination of parameters producing the most char and oil and the least gas from agricultural and forestry wastes were determined. The dominant influence of air/feed on char and oil yields, and the desirability of low values of this ratio were indicated. A preliminary design of a 200 ton/day mobile pyrolysis system for conversion of agricultural and forestry wastes into clean fuels was made and a simplified economic analysis conducted. GRA

N77-20611# National Bureau of Standards, Washington, D.C. Center for Building Technology.
APPLICATIONS OF THERMOGRAPHY FOR ENERGY CONSERVATION IN INDUSTRY
Charles W. Hurley and Kenneth G. Kreider Oct. 1976 34 p refs
(PB-259629/4; NBS-TN-923) Avail: NTIS HC A03/MF A01 CSCL 10A

Infrared thermography was developed as a tool to measure the temperature of various types of surfaces. To assist energy conservation engineers to assess heat losses in industrial plants, a survey was conducted of furnaces and heating systems in addition to electrical and mechanical systems. This qualitative survey was found to be an excellent method to detect heat losses in unit process equipment and auxiliary systems. GRA

N77-20612# Air Force Academy, Colo.
THE SPATIAL CHARACTERISTICS OF THREE WYOMING FUELS Final Report
Melvin M. Vuk Jun. 1976 60 p refs
(AD-A030873; USAFA-TR-76-15) Avail: NTIS HC A04/MF A01 CSCL 05/3

This paper examines the development patterns of Wyoming's petroleum, natural gas, and coal resources. The emphasis is on the location of the resources and their movements. The author suggests, through the use of a limited number of measurements, that the spatial characteristics of Wyoming fuels have displayed a mutable nature. It is posited that an examination of Wyoming's past experience might provide the state with a better understanding of the state's current position as a major fuel supplier.
Author (GRA)

N77-20613# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
PRODUCTION OF AMMONIA USING COAL AS A SOURCE OF HYDROGEN Annual Report
W. L. Laukhuf (Louisville Univ.) Oct. 1976 54 p
(PB-259388/7; IMMR12-PD10-76) Avail: NTIS HC A04/MF A01 CSCL 07A

The economic feasibility of using a coal gasifier as the required hydrogen production step in an ammonia synthesis plant was investigated. If such a technique was found to be feasible, large quantities of natural gas (the normal hydrogen feedstock for ammonia synthesis) could be released for other uses. A thermodynamic equilibrium model was used to predict the amount of hydrogen produced from a high-sulfur Western Kentucky coal feedstock for several coal gasification schemes. The hydrogen produced was then used to synthesize 1,200 tons of ammonia per day for economic comparison purposes. At the present, ammonia is selling for $200 per ton and upwards, based on a natural gas price of $1.00-$1.50 per million Btu. Assuming a coal cost of $20 per ton, it was estimated that several existing gasifiers could produce sufficient hydrogen so that ammonia processed in an integrated coal gasification-ammonia synthesis plant would cost less to produce than the current selling price. Costs to produce the ammonia were as low as $122 per ton. It was also found that other gasifiers, with only slight modifications in operating conditions, could also produce ammonia for less than $200 per ton. Problem areas requiring further study were identified for such an integrated plant. GRA

N77-20614# Federal Energy Administration, Washington, D.C. Office of Regulatory Programs.
FINDINGS AND VIEWS OF THE FEA CONCERNING THE EXEMPTION OF CERTAIN PETROLEUM PRODUCTS FROM MANDATORY ALLOCATION AND PRICE REGULATION
Oct. 1976 449 p
(PB-259315/0; FEA/H-76/441) Avail: NTIS HC A19/MF A01 CSCL 05C

The effect of freeing the following refined petroleum products from government allocation and price regulations is discussed: (1) residual fuel oil, (2) middle distillate fuel oil, (3) naphtha, gas oils and other special products; and (4) naphtha jet fuel. A review of government regulation of the petroleum industry and the market for the product to be exempted and an analysis of current and projected supply/demand relationships and pricing behavior with respect to each category of products are given.
GRA

N77-20615# Simulation Physics, Inc., Burlington, Mass.
SILICON THIN FILM CRYSTALLIZATION AND SOLAR CELL FABRICATION Quarterly Progress Report, Mar. - May 1976
A. R. Kirkpatrick, T. P. Shaughnessy, and M. Benkiki Jun. 1976 36 p refs
(Grant NSF AER-76-06096)
(PB-258949/7; QR-10045-1; NSF/RA-760198; QPR-1) Avail: NTIS HC A03/MF A01 CSCL 10B

A project was initiated to develop an economically practical polycrystalline silicon solar cell consisting of thin films deposited on large area glass sheet substrates. Initial preparations for film deposition, recrystallization, and characterization are described. The feasibility of several methods of recrystallization were demonstrated. A transfer technique using electrostatic bonding was achieved. GRA

N77-20616# Dow Chemical Co., Midland, Mich.
SOLAR ENERGY SUBSYSTEMS EMPLOYING ISOTHERMAL HEAT SINK MATERIALS Final Project Report, 18 Sep. 1974 - 18 Mar. 1976
George A. Lane, John S. Best, E. Colin Clarke, David N. Glew, George C. Karris, Steven W. Quigley, and Harold E. Rossow Mar. 1976 65 p refs Sponsored in part by ERDA
(Contract NSF C-906)
(PB-258738/4; NSF/RANN/SE/C-906/FR/76/1; NSF/RA-760202) Avail: NTIS HC A04/MF A01 CSCL 10C

Several encapsulation methods were studied: microencapsulation, encapsulation of powders and granules, and macroencapsulation. Microencapsulation of $CaCl2{:}6H2O$ in polyester resin has been successful, and small wall, floor, and ceiling panels have been prepared and tested. Macroencapsulation in plastic film containers appears promising for hot air systems. Preliminary economic analysis studies of heating systems based on heat-of-fusion storage materials have shown several promising approaches. GRA

N77-20617# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
EVALUATION OF THE SOLAR HEATING SYSTEM IN THE LOF RESIDENCE, DENVER, COLORADO Final Project Report, Jul. 1974 - 30 Nov. 1975
John C. Ward and George O. G. Lof Apr. 1976 64 p refs Submitted for publication
(Grant NSF AER-74-08566)
(PB-258845/7; NSF/RANN/SE/GI-143921/FR/76/1; NSF/RA-760224) Avail: NTIS HC A04/MF A01 CSCL 13A

The long-term performance of a residential solar air heating system was determined for a system which has been operating continuously since 1975 with no maintenance. The performance of this system was determined so that changes in performance occurring over a period of 15 years could be evaluated. GRA

N77-20618# Houston Univ., Tex. Dept. of Mechanical Engineering.
THE EVALUATION OF SURFACE GEOMETRY MODIFICATION TO IMPROVE THE DIRECTIONAL SELECTIVITY OF SOLAR ENERGY COLLECTORS Final Report, 1 Dec. 1973 - 31 Dec. 1975
John R. Howell and Richard B. Bannerot 31 May 1976 125 p refs

(Grant NSF AER-73-03357-A01)
(PB-258848/1; UHME/SOL/11;
NSF/AER-73-03357/A01/FR/76/1; NSF/RA-760200) Avail: NTIS HC A06/MF A01 CSCL 13A

The radiative performance of directionally selective collectors composed of parallel, east-west oriented, stationary, trapezoidal grooves was examined. Computer simulations for their radiative performance were developed. Experimental models of the collector geometry were constructed and tested. The radiative performance of these models was compared to that predicted, with good agreement achieved, verifying the computer simulations. Computer simulations of radiative behavior with direct beam, non-direct, and various combinations of insolation are presented. GRA

N77-20619# Illinois State Dept. of Business and Economic Development, Springfield. Div. of Energy.
ILLINOIS ENERGY CONSERVATION FEASIBILITY REPORT Final Report
May 1976 434 p refs
(PB-259390/3; DOE-76-07) Avail: NTIS HC A19/MF A01 CSCL 10A

An analysis is presented of more than 40 major energy conservation measures which might be implemented in Illinois. The potential for conserving energy is analyzed by fuel type for both the 1980 and 1985 time frame. Economic, social and environmental impacts of these energy conservation measures are also assessed. In addition, the report presents an analysis of Illinois' historic energy consumption record and forecasts. A methodology for preparing a definitive state energy conservation plan is outlined. GRA

N77-20620# Technology and Economics, Inc., Cambridge, Mass.
THE ENERGY VISTA: POLICY PERSPECTIVES ON ENERGY CONSERVATION THROUGH LAND USE MANAGEMENT
W. Curtiss Priest and Maria R. Elgerman 22 Jun. 1976 419 p refs
(Contract FEA-CO-04-50250-00)
(PB-259417/4; FEA/D-76/447) Avail: NTIS HC A18/MF A01 CSCL 10A

Results of research into the relationships between energy consumption and land use are discussed. The primary areas of investigation were: (1) implementation strategies-how to bring about energy conservation through land use changes, (2) growth policy-the regional, interregional and national growth trends and their relationship to energy consumption, and (3) new technology applications-the implications of alternative energy technologies and the potential impact of new telecommunications applications. GRA

N77-20621# Puerto Rico Univ., Mayaguez. Dept. of Marine Sciences.
OCEAN THERMAL ENERGY CONVERSION: RESOURCE ASSESSMENT AND ENVIRONMENTAL IMPACT FOR PROPOSED PUERTO RICO SITE Final Report
Donald Atwood (NOAA, Miami, Fla.), Peter Duncan, Marvel C. Stalcup (Woods Hole Oceanographic Institution, Woods Hole, Mass.), and Michael J. Barcelona Aug. 1976 107 p refs
(Grant NSF AER-75-00145)
(PB-259303/6; NSF/RA-760249) Avail: NTIS HC A06/MF A01 CSCL 10B

The possibility of extracting thermal energy stored in the tropical sea surface by ocean thermal energy conversion at a site near the town of Yabucoa, on the southeast coast of Puerto Rico was observed. A survey of existing oceanographic and meteorological data at and near the site and for other possible sites near Puerto Rico was made. A survey of the specific site to confirm the oceanographic conditions prevalent there is also cited. GRA

N77-20622# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
OPTIMIZATION AND CHARACTERISTICS OF A SAILWING WINDMILL ROTOR Final Report, 1 Feb. 1975 - 31 Jan. 1976
Mark D. Maughmer Mar. 1976 90 p refs
(Grant NSF GI-41891)
(PB-259898/5; AMS-1297; NSF/RA-76021) Avail: NTIS HC A05/MF A01 CSCL 10A

A detailed accounting of the development and operational techniques of the Princeton moving-vehicle windmill testing facility is discussed. A complete documentation of the performance build-up of a 12 ft. diameter, two-bladed sailwing rotor is presented. An examination of an exploratory research effort directed toward using a small, first-stage, coaxial rotor to augment windmill performance is included. The results and conclusions of an extensive wind-tunnel test program aimed at a quantitative determination of the aerodynamic penalties associated with numerous simplifications of the basic double-membraned sailwing cross-section are considered. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-20623# Rhode Island Univ., Kingston.
MARINE POLLUTION ARTICLES IN THE LAW OF THE SEA SINGLE INFORMAL NEGOTIATING TEXT
Dennis Livingston (Rensselaer Polytechnic Inst., Troy, N.Y.) Jun. 1976 37 p refs
(Grant NOAA-04-6-158-44002)
(PB-260581/4; Paper-31(76-2); NOAA-76090809) Avail: NTIS HC A03/MF A01 CSCL 05D

Articles on international prevention and control of marine pollution are contained in the document that emerged from the 1975 session of the UN Law of the Sea Conference. The marine environment was one of the major agenda items, and its portion of the text contains 44 articles. The text is in part a product of recent international experience in controlling marine pollution. GRA

N77-20624# Oak Ridge National Lab., Tenn.
REGIONAL ANALYSIS AND ENVIRONMENTAL IMPACT ASSESSMENT
D. C. Parzyck, R. W. Brocksen, and W. R. Emanuel 1976 25 p refs Presented at Symp. on Biol. Evaluation of Environ. Impact, New Orleans, 2 Jun. 1976
(Contract W-7405-eng-26)
(CONF-760656-1) Avail: NTIS HC A02/MF A01

Regional methodologies have been developed which examine impacts upon aquatic and terrestrial biota in regions through consideration of changes in land use, land cover, air quality, water resource use, and water quality. Techniques used to assess long-range atmospheric transport, water resources, effects on sensitive forest and animal species, and impacts on man are presented in this paper, along with an optimization approach which serves to integrate the analytical techniques in an overall assessment framework. A brief review of the research approach and certain modeling techniques used within one regional studies program is provided. ERA

N77-20625# Utah Univ., Salt Lake City.
AIRBORNE AIR POLLUTION MONITORING EXPERIMENT IN AN AREA OF MOUNTAIN-VALLEY TERRAIN
S. K. Kao and G. H. Taylor Jan. 1976 69 p refs Presented at Symp. on Atmospheric Turbulence, Diffusion, and Air Quality, Raleigh, N. C., 19 Oct. 1976
(Contract ET(11-1)-2455)
(COO-2455-7; Conf-761003-4) Avail: NTIS HC A04/MF A01

Using a conductivity-type analyzer, sulfur dioxide concentrations were measured at various locations downwind of a large copper smelter. A series of cross wind passes were flown, at incremental altitudes, to determine the concentration distribution of sulfur dioxide. Measured concentrations in the mountain-valley terrains were, in general, much lower than those predicted by the flat-surface diffusion model. It was felt that, since the smelter lies in an area of high relief, models intended for use over a flat surface would not be applicable for predicting plume concentrations in mountain-valley terrain; mechanical turbulence induced by mountain terrain near the source was thought to be the major cause of discrepancies between flat surface predictions and measured centerline concentrations. An analytic equation based on wind tunnel experiments was developed for use during

southerly to easterly flow to predict lateral dispersion parameters within the plume. ERA

N77-20626# Battelle Pacific Northwest Labs., Richland, Wash.
REGIONAL SCALE MODEL FOR COMPUTING DEPOSITION AND GROUND LEVEL AIR CONCENTRATION OF SO2 AND SULFATES FROM ELEVATED AND GROUND SOURCES
L. L. Wendell, D. C. Powell, and R. L. Drake May 1976 8 p refs Presented at the 3d Symp. on Atmospheric Turbulence, Diffusion and Air Quality, Raleigh, North Carolina, 19-22 Oct. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5654; Conf-761003-13) Avail: NTIS HC A02/MF A01

The model is presently in the form of a vehicle. It contains many of the essential elements, in varying degrees of approximation, needed to begin validation and assessment exercises. The approach in this effort was to maintain a balance between development and application. Validation efforts, assessment exercises, and comparisons with other models should suggest the priority of necessary improvement. These efforts are being undertaken in an attempt to develop tools for assessing the impact of power plant pollution. ERA

N77-20627# Battelle Pacific Northwest Labs., Richland, Wash. Dept. of Atmospheric Sciences.
ESTIMATION OF AIR CONCENTRATIONS DUE TO THE SUSPENSION OF SURFACE CONTAMINATION BY THE WIND
Thomas W. Horst Mar. 1976 49 p refs
(Contracts E(45-1)-2130; E(45-1)-1830)
(BNWL-2047) Avail: NTIS HC A03/MF A01

A mathematical model is developed for the calculation of air concentrations of material suspended by the wind from areas of surface contamination, and the model is applied specifically to the BC controlled area. Example computer solutions are given to show the dependence of the suspended air concentration on suspension rate, deposition velocity, wind speed, wind direction and atmospheric stability. This model is subsequently simplified to produce an analytical method for the economical estimation of air concentrations and horizontal fluxes of suspended surface contamination. The predictions of the analytical method are demonstrated to agree quite well with those of the more complex, computerized model. ERA

N77-20628# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
COMPARISON OF SIX NUMERICAL SCHEMES FOR CALCULATING THE ADVECTION OF ATMOSPHERIC POLLUTION
P. E. Long and D. W. Pepper 1976 8 p refs Presented at Symp. on Atmospheric Turbulence, Diffusion, and Air Quality, Raleigh, N. C., 19 Oct. 1976
(Contract AT(07-2)-1)
(DP-MS-76-1; Conf-761003-11) Avail: NTIS HC A02/MF A01

The numerical advection schemes considered are donor cell (a variant of upwind differencing); fully implicit; Crank-Nicolson; second moment method; quasi-Lagrangian-cubic spline; and chapeau function. The donor cell technique requires the least computation effort, but is the least accurate of the six methods when compared on the basis of artificial dispersion and dissipation. The remaining schemes require about the same programming effort and computer running time but yield substantially more accurate results. The fully implicit scheme is often less dissipative than the donor cell technique but is still unacceptably inaccurate. Little or no artificial dissipation is manifested by the final four schemes. Numerical calculations with constant and variable advection velocities support these conclusions. ERA

N77-20629# Royal Netherlands Meteorological Inst., De Bilt.
MANUAL FOR THE GAUSSIAN PLUME MODEL COMPUTER PROGRAM [HANDLEIDING VOOR HET COMPUTERPROGRAMMA VAN HET GAUSSISCHE PLUIMMODEL]
P. A. T. Nieuwendijk, C. A. Engeldal, and F. T. M. Nieuwstadt 1976 73 p refs In DUTCH; ENGLISH summary
(KNMI-WR-76-16) Avail: NTIS HC A04/MF A01

The Gaussian plume model, which simulates the dispersion of air pollution, and the input parameters of the model are discussed. A manual to operate the program is presented. The equations of the model are given, together with the values of the recommended input parameters. The structure of the program is described; the input is discussed in general form. Also, an input model is given together with three input examples. The output of the examples is discussed, and a listing of the program is given. The manual, which replaces the old version by Vermaas, 1975, facilitates the use of the computer program. Useful advice for future users of the long term model is annexed.
Author (ESA)

N77-20630# Transportation Systems Center, Cambridge, Mass.
WASTE OIL BURN-OFF IN COAST GUARD POWERPLANTS. WASTE OIL FILTERING SYSTEMS AND DIESEL ENGINE PERFORMANCE Final Report, Jan. - Sep. 1975
J. R. Hobbs and R. A. Walter Jun. 1976 58 p refs
(AD-A031064; TSC-USCG-76-1; USCG-D-78-76) Avail: NTIS HC A04/MF A01 CSCL 13/2

This report documents two tasks of a continuing study to determine the feasibility of burning waste lubricating oils in Coast Guard powerplants. The first task evaluated the effectiveness of two treatment devices for the clean-up of waste lubricating oil. It was found that a commercially available diesel filter pack is more effective than an oily-water separator. In the second task, exhaust emissions and performance were measured with a GM6-71 diesel engine when mixtures of lube oil in fuel oil up to 10 percent were burned. No short-term degradation in emissions or performance was observed. Author (GRA)

N77-20631# Pennsylvania State Univ., University Park. Center for Air Environment Studies.
ATMOSPHERIC INPUTS TO THE UPPER GREAT LAKES BY DRY DEPOSITION PROCESSES Final (Draft) Report
W. J. Moroz, R. L. Kabel, M. Taheri, A. C. Miller, and H. J. Hoffman 27 Jun. 1976 108 p refs Sponsored by Intern. Joint Comm.-US and Can.
(Grant EPA-R-005168)
(PB-258097/5; CAES-Pub-439-76; EPA-905/4-74-005) Avail: NTIS HC A06/MF A01 CSCL 13B

A Gaussian plume model was modified to estimate the input of specific atmospheric pollutants into the Upper Great Lakes by dry deposition processes. The specific pollutants were: (1) total dissolved solid, (2) chlorides, (3) total nitrogen, (4) total phosphorus, (5) total silica, and (6) pesticides. Pollutant removal at a land or water surface by dry deposition processes was accounted for by including a deposition factor in front of the image terms in the conventional Gaussian concentration equation. The inclusion of this deposition factor necessitated a second equation which modeled the flux of material to the surface.GRA

N77-20632# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Medical and Biologic Effects of Environmental Pollutants.
OZONE AND OTHER PHOTOCHEMICAL OXIDANTS. VOLUME 1 (CHAPTERS 1-7)
Aug. 1976 552 p refs
(Contract EPA-68-02-1226)
(PB-260570/7; EPA-600/1-76-027a-Vol-1) Avail: NTIS HC A24/MF A01 CSCL 06F

The origins and effects of ozone and other photochemical oxidants is discussed. It is limited, more or less, to the problem of urban pollution and to such closely related topics as natural background in the earth's boundary layer. No consideration is given to the stratospheric ozone layer and the effects produced by supersonic transport emissions or halocarbons. Volume one of the report is concerned with the origins and measurement of ozone and other photochemical oxidants and the relationship of atmospheric concentrations to emissions. GRA

N77-20633# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Medical and Biologic Effects of Environmental Pollutants.
OZONE AND OTHER PHOTOCHEMICAL OXIDANTS. VOLUME 2 (CHAPTERS 8-15)
Aug. 1976 640 p refs
(Contract EPA-68-02-1226)
(PB-260571/5; EPA-600/1-76-027B) Avail: NTIS

HC A99/MF A01 CSCL 06F

The origins and effects of ozone and other photochemical oxidants are discussed. It is limited, more or less, to the problem of urban pollution and to such closely related topics as natural background in the earth's boundary layer. No consideration is given to the stratospheric ozone layer and the effects produced by supersonic transport emissions or halocarbons. Volume two deals with toxicologic studies and effects on humans, and with effects on plants, ecosystems, and materials. GRA

N77-20634# Midwest Research Inst., Kansas City, Mo.
PARTICLE EMISSION REACTIVITY Final Report, Feb. - Jun. 1976
K. P. Ananth, J. B. Galeski, and F. I. Honea Sep. 1976 81 p refs
(Contract EPA-68-02-1324)
(PB-259300/2; EPA-600/2-76-257) Avail: NTIS HC A05/MF A01 CSCL 13B

Historical trends of particulate, SOx, and NOx emissions and of acid rain in the northeastern U.S.; studying size and composition of particulates from power plants; and analyzing interactions between particulates and sulfur-bearing gases from coal-fired power plants. Particulate mass emissions from industrial and combustion sources project a rising trend, nationwide, if no additional controls are assumed. SO2 emissions have been increasing nationwide since 1950; without additional controls and with a 5% industry growth, this trend is expected to continue. NOx-mass emissions have increased consistently since 1920; those for 1970 were more than 3 times those for 1920. GRA

N77-20635# Oklahoma Water Resources Research Inst., Stillwater.
DEMONSTRATION OF WATER QUALITY ENHANCEMENT THROUGH THE USE OF THE GARTON PUMP
James E. Garton and Howard R. Jarrell 1976 25 p
(Contract DI-14-31-0001-4215)
(PB-259601/3; W77-00669; OWRT-C-5228(4215)(2)) Avail: NTIS HC A02/MF A01 CSCL 13B

A low-energy destratifier using a 1.83 propeller to pump water downward from the surface has been used successfully to destratify a 100 acre lake (35 feet deep) for three years. This project involved using the pump on Lake Okatibbee, a broad, shallow lake of approximately 1,537 ha (38,000 Ac) with a maximum depth of slightly over ten meters. From the data obtained it is evident that the Garton Pump can indeed induce water from the epilimnion to flow downward into the intake structure so that the water actually released has the characteristics of the near surface water of the lake. GRA

N77-20636# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
COMMERCIAL FEASIBILITY OF AN OPTIMUM RESIDENTIAL OIL BURNER HEAD Final Report, Jun. 1975 - Feb. 1976
L. P. Combs and A. S. Okuda Sep. 1976 114 p refs
(Contract EPA-68-02-1888)
(PB-259912/4; EPA-600/2-76-256; R-76-103) Avail: NTIS HC A06/MF A01 CSCL 13B

Prototype commercial heads were fabricated. Research combustion chamber tests showed these to be equivalent to the earlier research head. Tested as retrofit replacements for stock burner heads in two new warm-air oil furnaces, the prototype heads were found to be operationally satisfactory and potentially durable and long-lived. It was estimated that widespread retrofitting of old residential units could increase mean season-averaged thermal efficiency (averaged over those units retrofitted) by about 5 percent and simultaneously reduce NOx emissions from these sources by about 20 percent. Logistics of a retrofit program, training for service personnel, and requirements to ensure meeting codes and standards were not resolved. GRA

N77-20637# Meteorology Research, Inc., Altadena, Calif.
DETERMINATION OF THE FRACTIONAL EFFICIENCY, OPACITY CHARACTERISTICS, ENGINEERING AND ECONOMIC ASPECTS OF A FABRIC FILTER OPERATING ON A UTILITY BOILER Final Report
David S. Ensor, Richard G. Hooper, and Robert W. Scheck Nov. 1976 206 p refs Sponsored by EPRI
(PB-261472/5; EPRI-FP-297) Avail: NTIS HC A10/MF A01 CSCL 13B

The fabric filter baghouse was evaluated with a field performance test and engineering analysis. The overall collection efficiency determined with impactors was 99.92 percent at 12 Mw with outlet mass concentrations of less than 0.0011 gr/cu ft. The outlet opacity was capital cost (including all retrofit construction costs related to the collector) was $87/kw. The operating costs are 1.53 mills per kwh for 1976 based on a 55 percent capacity factor. The installation of thimble flow straighteners reduced premature bag failures due to bag erosion. GRA

N77-20638# KVB Engineering, Inc., Tustin, Calif.
EFFECTIVENESS OF GAS RECIRCULATION AND STAGED COMBUSTION IN REDUCING NOx ON A 560-MW COAL-FIRED BOILER
R. C. Carr Sep. 1976 112 p refs
(PB-260582/2; EPRI-FP-257) Avail: NTIS HC A06/MF A01 CSCL 13B

A field test program was conducted to determine the feasibility of using the flue gas recirculation into the combustion air and two-stage combustion to reduce nitric oxide emissions on pulverized coal-fired utility boilers. Nitric oxide emissions were documented as a function of gas recirculation rate, excess oxygen level, unit load, and burner out-of-service pattern. Four basic boiler firing configurations were compared. Windbox gas recirculation is relatively ineffective in reducing NO emissions by comparison to two-stage combustion. GRA

N77-20639# International Flame Research Foundation, Ijmuiden (Netherlands).
BURNER CRITERIA FOR NOx CONTROL VOLUME 1: INFLUENCE OF BURNER VARIABLES ON NOx IN PULVERIZED COAL FLAMES Final Report, Jun. 1971 - Jun. 1974
M. P. Heap, T. M. Lowes, R. Walmsley, H. Bartelds, and P. LeVaguerese Mar. 1976 171 p refs
(Contract EPA-68-02-0202)
(PB-259911/6; EPA-600/2-76-061A-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13B

NO formation can be controlled by optimizing burner design parameters because its rate of formation depends on the detailed mixing history of the fuel, combustion air, and recirculating combustion products. The same parameters also dictate such flame characteristics as stability, length, and luminosity. An explanation of the influence of burner parameters on pulverized coal flames is based on two assumptions: the most significant factor of the total emission is fuel NO, and the emission variation depends on the fate of the volatile nitrogen compounds. Fuel NO formation can be reduced by ensuring that the volatile nitrogen compounds react under oxygen deficient conditions. Maximum emissions occur with radial fuel injects because the coal is rapidly mixed with the total air supply and hot recirculating products. GRA

N77-20640# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
CONTROL OF VOLATILE ORGANIC EMISSIONS FROM EXISTING STATIONARY SOURCES
Nov. 1976 175 p refs
(PB-260386/8; EPA-450/2-76-028-Vol-1;
OAQPS-1.2-067-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13B

Graphs are given to determine the cost of incinerators at varying volumes and variation in inlet temperature, vapor concentration, degree of heat recovery, fuel costs, and hours of operation. Graphs are given to determine the cost of carbon adsorbers under varying volumes and vapor concentration. The available methods of measuring volatile organic emissions are discussed. GRA

N77-20641# Denver Research Inst., Colo.
DENVER AIR POLLUTION STUDY - 1973. PROCEEDINGS OF A SYMPOSIUM, VOLUME 1 Final Report, Jan. 1974 - Jun. 1976
Philip A. Russell Jun. 1976 234 p refs Proc. of Symp., Mar. 1975

(Grant EPA-R-980590)
(PB-259872/0; EPA-600/9-76-007A-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 13B

Gaseous and aerosol pollutants, and meteorological parameters were measured periodically under selected conditions. A symposium was held to present and discuss the results of this study. The papers cover local windflow patterns; Lidar observations; Aitken, cloud, and ice nuclei concentrations; and hydrocarbon analyses. GRA

N77-20642# Automotive Environmental Systems, Inc., Westminster, Calif.
ACCELERATED DECAY OF NON-FUEL EVAPORATIVE EMISSIONS Final Report
Aug. 1976 47 p
(Contract EPA-68-03-2413)
(PB-259585/8; EPA-460/3-76-026) Avail: NTIS HC A03/MF A01 CSCL 14B

Daily background evaporative emission tests were performed on two groups of three identical Ford LTD's. All fuel system components were either removed or plugged. The carburetors were removed and the intake manifolds covered with plate. An auxiliary fuel system was used when running each vehicle on the dynamometer. Daily testing was begun on each vehicle within nine days after manufacturing. One vehicle in each group was a control vehicle, which soaked between daily tests. GRA

N77-20643# URS Research Co., San Mateo, Calif.
PROCEDURES FOR EVALUATING OPERATIONS OF AMBIENT AIR MONITORING NETWORKS: A MANUAL
Ruth W. Shnider and Edwin S. Shapiro Aug. 1976 92 p refs
(Contract EPA-68-03-0473)
(PB-259782/1; EPA-600/4-76-043) Avail: NTIS HC A05/MF A01 CSCL 13B

The efficiency of ambient air monitoring networks is evaluated, whose primary objective is to document compliance with or progress toward attaining ambient air quality standards. Methods to evaluate the efficiency of each of six operational areas are provided: network plan and design, personnel qualifications facilities and equipment, sampling and analysis, quality assurance, and data utilization. A technique is presented for the overall integrated evaluation of the operational areas. GRA

N77-20644# Mote Marine Lab., Sarasota, Fla.
THE ECOLOGICAL IMPACT OF SYNTHETIC ORGANIC COMPOUNDS ON ESTUARINE ECOSYSTEMS
Jeffrey L. Lincer, Marita E. Haynes, and Marian L. Klein Sep. 1976 364 p refs
(PB-259943/9; EPA-600/3-76-075) Avail: NTIS HC A16/MF A01 CSCL 06F

The review and indexed bibliography concern the presence and effects of pesticides (i.e., insecticides, herbicides, fungicides, etc.) and industrial toxicants in the estuarine ecosystem. The industrial toxicants refer, primarily, to polychlorinated biphenyls, but phthalate esters, polychlorinated terphenyls, chlorinated dibenzodioxins and dibenzofurans are also discussed. GRA

N77-20645# Battelle Columbus Labs., Ohio.
SMOG CHAMBER STUDIES ON PHOTOCHEMICAL AEROSOL-PRECURSOR RELATIONSHIPS Final Report, Jun. 1974 - Aug. 1975
David F. Miller and Darrell W. Joseph Jul. 1976 125 p refs
(Contract EPA-68-02-1718)
(PB-258828/3; EPA-600/3-76-080) Avail: NTIS HC A06/MF A01 CSCL 07E

An experimental program was conducted in which controlled atmospheres containing water vapor, CO, NOx (NO + NO2), and a constant distribution of 17 hydrocarbons (NMHC) were irradiated in a smog chamber. Reaction profiles were developed for NO oxidation, hydrocarbon oxidation, ozone formation, and aerosol formation over 10 hour irradiation periods. Comparison of smog chamber results with data on hydrocarbon oxidation rates observed in the Los Angeles area and with worst case ozone episodes in that area, suggest that the models (precursor relationships) developed for photochemical aerosol formation are highly relevant to smog problems in polluted atmospheres. GRA

N77-20646# Beckman Instruments, Inc., Anaheim, Calif. Advanced Technology Operations.
EVALUATION OF MONITORING SYSTEMS FOR POWER PLANT AND SULFUR RECOVERY PLANT EMISSIONS Final Report, Jun. 1974 - Jun. 1975
Malbone W. Greene, Robert L. Chapman, Samuel C. Creason, R. Neal Harvey, and Glen A. Heyman Jun. 1976 202 p
(Contract EPA-68-02-1743)
(PB-258868/9; FR-2678-102; EPA-600/2-76-171) Avail: NTIS HC A10/MF A01 CSCL 07B

This project was conducted to evaluate a number of commercially available extractive-type sampling and monitoring systems for monitoring sulfur dioxide and hydrogen sulfide source emissions. Evaluation testing was performed at a fossil fuel fired power plant and at a sulfur recovery plant to obtain representative ranges of stack gas temperature, water and particulate loading, and corrosiveness. Tests of calibration error, relative accuracy, two and twenty four hour zero and calibration drifts, response time, and operational period were performed in accordance with published EPA guidelines. GRA

N77-20647# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
STANDARD SUPPORT AND ENVIRONMENTAL IMPACT STATEMENT. VOLUME 2: PROMULGATED EMISSION STANDARD FOR VINYL CHLORIDE
Sep. 1976 208 p
(PB-258827/5; EPA-450/2-75-009b-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 13B

A national emission standard for vinyl chloride emitted from ethylene dichloride-vinyl chloride and polyvinyl chloride plants is being promulgated under the authority of section 112 of the Clean Air Act. This document contains a summary of the public comments on the proposed standard and EPA's responses to the comments. It also contains updated information concerning the environmental and inflationary impacts of the standard. GRA

N77-20648# Environmental Research Lab., Athens, Ga.
CHEMICAL AND PHOTOCHEMICAL TRANSFORMATION OF SELECTED PESTICIDES IN AQUATIC SYSTEMS Final Report
N. Lee Wolfe, Richard G. Zepp, George L. Baughman, Robert C. Fincher, and John A. Gordon Sep. 1976 153 p refs
(PB-258846/5; EPA-600/3-76-067) Avail: NTIS HC A08/MF A01 CSCL 07E

The processes treated in most detail are hydrolysis, direct photolysis, and reaction with singlet oxygen. Implications of other processes such as oxidation and sensitized photolysis are also discussed. Results of detailed studies are included for the pesticides, malathion, carbaryl, methoxychlor, captan, and 2,4-D esters. The measured rate constants and half-lives indicate that chemical and/or photochemical processes of these compounds are likely to be important in the aquatic environment. Less extensive data is presented for the pesticides, atrazine, diazinon, parathion, and toxaphene, along with a discussion of available literature data. GRA

N77-20649# Environmental Sciences Research Lab., Research Triangle Park, N.C. Meteorology and Assessment Div.
THE GAUSSIAN-PLUME MODEL WITH LIMITED VERTICAL MIXING Final Report, Apr. 1976 - May 1976
F. Pasquill Aug. 1976 20 p refs
(PB-258732/7; EPA-600/4-76-042) Avail: NTIS HC A02/MF A01 CSCL 13B

Application of the Gaussian-plume model for atmospheric dispersion from an elevated source in a mixing layer of limited depth normally involves consideration of multiple reflections of the plume between the upper and lower boundaries. The present analysis considers some simple approximation formulae that should be useful in practical applications. GRA

N77-20650# TRW Systems Group, Redondo Beach, Calif.
CHARGED DROPLET SCRUBBER FOR FINE PARTICLE CONTROL: LABORATORY STUDY Final Phase Report, Jun. 1973 - Jun. 1975
C. W. Lear Sep. 1976 183 p refs
(Contract EPA-68-02-1345)

(PB-258823/4; EPA-600/2-76-249a) Avail: NTIS HC A09/MF A01 CSCL 07A

In the charged droplet scrubber the electrical interaction mechanisms exist in addition to the normal impact and diffusional scrubbing mechanisms. Electrical interaction is strong in the 0.1 to 1.0 micron particulate size range where the normal mechanisms lack effectiveness. Collection efficiencies as high as 80% for 0.1 micron and 90% for 1 micron particles were demonstrated in a three-stage unit. Induced charging or dry charging of particulate by charge transfer from droplets is an effective and major collection mechanism in the fine particulate size range. Large (100 micron) droplets give better performance characteristics than small (10 micron) droplets. GRA

N77-20651# Envirex, Inc., Milwaukee, Wis. Environmental Sciences Div.

METHODOLOGY FOR THE STUDY OF URBAN STORM GENERATED POLLUTION AND CONTROL

Richard E. Wullschleger, Alphonse E. Zanoni, and Charles A. Hansen Aug. 1976 345 p refs

(Contract EPA-68-03-0335)

(PB-258743/4; EPA-600/2-76-145) Avail: NTIS HC A15/MF A01 CSCL 08H

Recommendations are given for standard procedures to be followed in the conduct of projects dealing with pollution assessment and abatement of storm generated discharges. The purpose of this project was to develop standard procedures needed to insure that all discharges and treatment processes could be evaluated by the same means. The procedures chosen were those found to be the most applicable and optimum for the field of storm and combined sewer overflow pollution control. GRA

N77-20652# Savannah River Ecology Lab., Aiken, S.C.

FATE AND BIOLOGICAL EFFECTS OF MERCURY INTRODUCED INTO ARTIFICIAL STREAMS Final Report

Henry J. Kania, Robert L. Knight, and Robert J. Beyers Aug. 1976 141 p refs

(Grant EPA-R-800510)

(PB-258833/3; EPA-600/3-76-060) Avail: NTIS HC A07/MF A01 CSCL 13B

Mercuric ion was continuously input to artificial stream channels to provide water concentrations of 0.01, 1.0, and 5.0 micrograms/l. Channel components were periodically sampled for total mercury analyses. The effects of mercury on the algal components of the periphyton communities and on the benthic insects were determined. The sampling program continued one full year after mercury inputs were stopped. Approximately 15% of the added mercury was removed from the water. The community components acquired very high concentrations of mercury, although in most cases the levels in these were not a linear function of the water levels. Concentrations in invertebrates decreased most rapidly after mercury inputs were stopped while the sediment levels decreased most slowly. GRA

N77-20653# United Technologies Research Center, East Hartford, Conn.

INFLUENCE OF AERODYNAMIC PHENOMENA ON POLLUTANT FORMATION IN COMBUSTION (PHASE 1: GASEOUS FUELS) Final Report, Apr. 1975 - May 1976

L. J. Spadaccini, F. K. Owen, and C. T. Bowman Sep. 1976 153 p refs

(PB-258904/2; EPA-600/2-76-247A) Avail: NTIS HC A08/MF A01 CSCL 13B

The effects of the interaction between fluid dynamics and chemistry on pollutant formation and destruction in a natural-gas-fired, turbulent diffusion flame burner were investigated. The effects of inlet air swirl, combustor pressure, and air/fuel velocity ratio on the time-mean and fluctuating flow field were determined using probing and optical techniques. Changes in flow field structure were correlated with changes in pollutant emissions from the furnace. The investigation also showed that varying these parameters produces major changes in the time-mean flow field within the burner which significantly influence pollutant formation. It was also discovered that there are substantial large-scale contributions to the total rms turbulent velocity field. These large scale fluctuations result in significant departures from Gaussian turbulence and isotropy in the initial mixing regions of the burner and have pronounced effects on mixing, chemical reaction, and pollutant formation. GRA

N77-20654# Environmental Protection Agency, Washington, D.C. Technology Assessment and Evaluation Branch.

AUTOMOBILE EMISSION CONTROL: THE CURRENT STATUS AND DEVELOPMENT TRENDS AS OF MARCH 1976

Apr. 1976 298 p refs

(PB-259133/7) Avail: NTIS HC A13/MF A01 CSCL 13B

A summary and evaluation of the development programs of automobile manufacturers and other organizations involved in the development of automobile emission control technology are reported. GRA

N77-20655# Environmental Protection Agency, Cincinnati, Ohio. Office of Technology Transfer.

IN-PROCESS POLLUTION ABATEMENT. VOLUME 1: UPGRADING METAL-FINISHING FACILITIES TO REDUCE POLLUTION

Jul. 1973 73 p refs

(PB-260546/7; EPA-625/3-73-002-Vol-1) Avail: NTIS HC A04/MF A01; also available from Environmental Protection Agency, Office of Technology Transfer, Cincinnati, Ohio 45268 CSCL 11F

The first volume assists the metal finisher to understand where his pollution begins and how to reduce it and, having done so, to have a proper assemblage of facts so that his future endeavors at pollution control are not just self-servicing, but technologically sound and not inclined to obsolescence. In the second volume, water pollution and air pollution associated with metal-processing are evaluated and determinations made concerning feasible alternatives to wastewater treatment of metal-processing waste. GRA

N77-20656# Fluor Engineers and Constructors, Inc., Los Angeles, Calif.

ECONOMICS OF A FREEZE DESALTING PROCESS USING COLD SEAWATER EFFLUENT OF A LIQUID NATURAL GAS PLANT Final Report

Mar. 1976 61 p

(Contract DI-14-30-3313)

(PB-259272/3; W77-00635; OWRT-S-76/52) Avail: NTIS HC A04/MF A01 CSCL 07A

The technical feasibility and economic attractiveness of using cold sea water from an LNG plant in an adjacent sea water freeze desalting plant are discussed, along with the degree to which this would improve the environmental impact of the LNG plant. The basis for comparison is a secondary refrigerant process, the AVCO crystallex process. GRA

N77-20657# Science Applications, Inc., La Jolla, Calif.

APPLICATION OF REMOTE TECHNIQUES IN STATIONARY SOURCE AIR EMISSION MONITORING

C. B. Ludwig and M. Griggs Jun. 1976 166 p refs

(Contract EPA-68-03-2137)

(PB-258853/1; SAI-76-687-LJ; EPA-340/1-76-005) Avail: NTIS HC A08/MF A01 CSCL 07D

The usefulness of remote sensing techniques for monitoring the gaseous and particulate emissions from stationary sources was analyzed. The status active and passive remote monitoring instruments were evaluated. Results confirmed that the technique of differential absorption has the best sensitivity for the single-ended measurement of gaseous and particulate pollutants. In general, data interpretation problems of the passive techniques make them less accurate than the active methods. GRA

N77-20658# Charles River Associates, Inc., Cambridge, Mass.

THE EFFECT OF AUTOMOTIVE FUEL CONSERVATION MEASURES ON AIR POLLUTION Final Report

Robin Landis Sep. 1976 598 p

(Contract EPA-68-01-2481)

(PB-259908/2; CRA-218) Avail: NTIS HC A25/MF A01 CSCL 10A

A number of policies were designed to reduce gasoline consumption by automobiles, including: gasoline rationing; increases in the federal excise tax on gasoline; excise taxes on new cars in inverse proportion to their fuel economy; and

regulations to set minimum levels on average fuel economy of new cars. The impact on fuel consumption by automobiles and by other competing modes of transportation is addressed, if different levels of these policies are put into effect, and the impact these policies would have on emissions and concentrations of automotive pollutants. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N77-20659*# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Science.

TECHNIQUES FOR COMPUTING REGIONAL RADIANT EMITTANCES OF THE EARTH-ATMOSPHERE SYSTEM FROM OBSERVATIONS BY WIDE-ANGLE SATELLITE RADIOMETERS, PHASE 3 Final Report, 1 Jan. - 31 Dec. 1974

Jose F. Pina and Frederick B. House Aug. 1975 126 p refs
(Contract NAS1-11871)
(NASA-CR-145011) Avail: NTIS HC A07/MF A01 CSCL 04A

Radiometers on earth orbiting satellites measure the exchange of radiant energy between the earth-atmosphere (E-A) system and space at observation points in space external to the E-A system. Observations by wideangle, spherical and flat radiometers are analyzed and interpreted with regard to the general problem of the earth energy budget (EEB) and to the problem of determining the energy budget of regions smaller than the field of view (FOV) of these radiometers. Author

N77-20660*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

THE GLOBAL REFERENCE ATMOSPHERIC MODEL, MOD 2 (WITH TWO SCALE PERTURBATION MODEL) Interim Technical Report

C. G. Justus and W. R. Hargraves Jul. 1976 262 p refs
(Contract NAS8-20657)
(NASA-CR-150214) Avail: NTIS HC A12/MF A01 CSCL 04A

The Global Reference Atmospheric Model was improved to produce more realistic simulations of vertical profiles of atmospheric parameters. A revised two scale random perturbation model using perturbation magnitudes which are adjusted to conform to constraints imposed by the perfect gas law and the hydrostatic condition is described. The two scale perturbation model produces appropriately correlated (horizontally and vertically) small scale and large scale perturbations. These stochastically simulated perturbations are representative of the magnitudes and wavelengths of perturbations produced by tides and planetary scale waves (large scale) and turbulence and gravity waves (small scale). Other new features of the model are: (1) a second order geostrophic wind relation for use at low latitudes which does not 'blow up' at low latitudes as the ordinary geostrophic relation does; and (2) revised quasi-biennial amplitudes and phases and revised stationary perturbations, based on data through 1972. Author

N77-20661*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

RESEARCH STUDY ON NEUTRAL THERMODYNAMIC ATMOSPHERIC MODEL Final Report

W. R. Hargraves, E. B. Delulio, and C. G. Justus Jan. 1977 255 p
(Contract NAS8-30657)
(NASA-CR-150215) Avail: NTIS HC A12/MF A01 CSCL 04A

The Global Reference Atmospheric Model is used along with the revised perturbation statistics to evaluate and computer graph various atmospheric statistics along a space shuttle reference mission and abort trajectory. The trajectory plots are height vs. ground range, with height from ground level to 155 km and ground range along the reentry trajectory. Cross sectional plots, height vs. latitude or longitude, are also generated for 80 deg longitude, with heights from 30 km to 90 km and latitude from -90 deg to +90 deg, and for 45 deg latitude, with heights from 30 km to 90 km and longitudes from 180 deg E to 180 deg W. The variables plotted are monthly average pressure, density, temperature, wind components, and wind speed and standard deviations and 99th inter-percentile range for each of these variables. Author

N77-20662*# Old Dominion Univ. Research Foundation, Norfolk, Va.

A STUDY ON CHARACTERIZATION OF STRATOSPHERIC AEROSOL AND GAS PARAMETERS WITH THE SPACECRAFT SOLAR OCCULTATION EXPERIMENT Final Report, 1 Oct. 1975 - 31 Dec. 1976

William P. Chu Mar. 1977 27 p refs
(Grant NsG-1259)
(NASA-CR-152623; PGSTR-PH77-51) Avail: NTIS HC A03/MF A01 CSCL 04A

Spacecraft remote sensing of stratospheric aerosol and ozone vertical profiles using the solar occultation experiment has been analyzed. A computer algorithm has been developed in which a two step inversion of the simulated data can be performed. The radiometric data are first inverted into a vertical extinction profile using a linear inversion algorithm. Then the multiwavelength extinction profiles are solved with a nonlinear least square algorithm to produce aerosol and ozone vertical profiles. Examples of inversion results are shown illustrating the resolution and noise sensitivity of the inversion algorithms. Author

N77-20663*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SIMPLIFIED METHODS FOR CALCULATING PHOTODISSOCIATION RATES

Tatsuo Shimazaki, Toshihiro Ogawa (Tokyo Univ.), and B. C. Farrell Mar. 1977 41 p refs
(NASA-TN-D-8399; A-6811) Avail: NTIS HC A02/MF A01 CSCL 04A

Simplified methods for calculating the transmission of solar UV radiation and the dissociation coefficients of various molecules are compared. A significant difference sometimes appears in calculations of the individual band, but the total transmission and the total dissociation coefficients integrated over the entire SR (solar radiation) band region agree well between the methods. The ambiguities in the solar flux data affect the calculated dissociation coefficients more strongly than does the method. A simpler method is developed for the purpose of reducing the computation time and computer memory size necessary for storing coefficients of the equations. The new method can reduce the computation time by a factor of more than 3 and the memory size by a factor of more than 50 compared with the Hudson-Mahle method, and yet the result agrees within 10 percent (in most cases much less) with the original Hudson-Mahle results, except for H2O and CO2. A revised method is necessary for these two molecules, whose absorption cross sections change very rapidly over the SR band spectral range. Author

N77-20664# California Univ., Livermore. Lawrence Livermore Lab.

ATMOSPHERIC DISPERSION AND NOISE PROPAGATION AT IMPERIAL VALLEY GEOTHERMAL FIELDS

R. E. Kelly 15 Apr. 1976 29 p refs
(Contract W-7405-eng-48)
(UCRL-52053) Avail: NTIS HC A03/MF A01

Quantitative estimations are made for the atmospheric dispersion of gases, heat, and noise due to geothermal energy sources in Southern California's Imperial Valley. In particular, gas concentration per unit source strength, change in mixing ratio, relative humidity, temperature, and the ratio of heat flux to solar constant are calculated. The possibility of atmospheric refraction of source noise is also considered. ERA

N77-20665# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Garmisch-- Partenkirchen (West Germany). Inst. fuer Atmosphaerische Umweltforschung.

MEASUREMENT OF AIRBORNE RADIOACTIVITY AND ITS METEOROLOGICAL APPLICATION, PART 5 Annual Report, 1 Apr. 1973 - 31 Jul. 1974

R. Reiter, H. J. Kanter, R. Sladkovic, and K. Poetzl Mar. 1976 139 p refs
(Contract E(11-1)-3425)
(NYO-3425-12) Avail: NTIS HC A07/MF A01

Results are reported from studies on the exchange of air between stratosphere and troposphere. Continuous data on the concentrations of the radio-nuclides Be7, P32, P33, and S35, of the fallout and ozone are reported. The meteorological analysis of five intrusions of stratospheric air is presented. ERA

N77-20666# Oak Ridge National Lab., Tenn.
COMEX COMPUTER CODE: MONTE CARLO ANALYSIS OF ECOSYSTEM ATTRIBUTES
J. B. Mankin, R. H. Gardner, and H. H. Shugart 1976 5 p refs Presented at Summer Computer Simulation Conf., Washington, D. C., 12 Jul. 1976 Sponsored by ERDA
(CONF-760703-4) Avail: NTIS HC A02/MF A01

The general method used is to perform successive simulations with a linear, stationary system with certain parameters chosen from a multivariate-normal sample of specified mean and variance. The results of simulations on two hypothetical terrestrial food chain models indicate that parameter values for these models must be measured with variability less than 20 percent if meaningful model predictions are expected. The application of this technique will allow quantitative comparison of many ecosystem models. ERA

N77-20667# Los Alamos Scientific Lab., N.Mex.
ATMOSPHERIC TRANSPORT AND DISPERSAL AT A SITE DOMINATED BY COMPLEX TERRAIN
William E. Clements and S. Barr 1976 7 p refs Presented at Symp. on Atmospheric Turbulence, Diffusion, and Air Quality, Raleigh, N. C., 19 Oct. 1976
(Contract W-7405-eng-48)
(LA-UR-76-1068; Conf-761003-7) Avail: NTIS HC A02/MF A01

There is evidence that the stable nocturnal periods tend to amplify the terrain anomalies of particle transport and diffusion from the predictions of the traditional models. In an effort to identify phenomena which might create anomalous dispersion patterns, preliminary field work has been done in a typical canyon-mesa environment at Los Alamos, N. M. The early experiments focused on time and space variations of the dominant nocturnal drainage wind. ERA

N77-20668# California Univ., Livermore. Lawrence Livermore Lab.
SATELLITE OZONE ANALYSIS CENTER (SOAC)
James E. Lovill, T. J. Sullivan, J. B. Knox, and J. A. Korver Aug. 1976 17 p refs Presented at Symp. on Atmospheric Ozone, Dresden, 9-17 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-78092; Conf-760833-2) Avail: NTIS HC A02/MF A01

Proposals are presented for monitoring of the Earth's ozone variability to establish a baseline upon which regional, as well as global, ozone trends can be measured. ERA

N77-20669# California Univ., Livermore. Lawrence Livermore Lab.
NO/SUB x/ CATALYTIC OZONE DESTRUCTION: SENSITIVITY TO RATE COEFFICIENTS
William H. Duewer, Donald J. Wuebbles, Hugh W. Ellsaesser, and Julius S. Chang 27 Jul. 1976 10 p refs Presented at Symp. on Atmospheric Ozone/Atmospheric Chemistry and Global Pollution, Dresden, 9-17 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-78037; Conf-760833-1) Avail: NTIS HC A02/MF A01

An important observation is that the computed ambient concentrations from the various models were all in comparable agreement with observations. Some conclusions that can be drawn from this study include: uncertainties in chemical rate coefficients can produce major uncertainties in ozone perturbations resulting from NO/sub x/ injections. Models predicting very different responses of ozone to NO/sub x/ injections can all be consistent with the observed stratospheric concentrations of minor species. Thus, there are clear limitations on the utility of stratospheric observations in estimating the reliability of models as predictive tools. The best way to reduce the uncertainty of model predictions will be to accurately measure uncertain rate coefficients. ERA

N77-20670# California Univ., Livermore. Lawrence Livermore Lab.
MODELING THE PLANETARY BOUNDARY LAYER USING THE GALERKIN FINITE-ELEMENT METHOD
Philip M. Gresho, Robert L. Lee, and Robert L. Sani (Ill. Univ., Urbana) 28 Apr. 1976 9 p refs Presented at Symp. on Atmospheric Turbulence, Diffusion, and Air Quality, Raleigh, N. C., 19-21 Oct. 1976
(Contract W-7405-eng-48)
(UCRL-78120; Conf-761003-19) Avail: NTIS HC A02/MF A01

Finite-element-methods computer programs that approximate the solution to the advection-diffusion equation are discussed for planetary boundary layer modeling. It has application in regional modeling studies and in real-time accident situations relative to air pollution monitoring. ERA

N77-20671# California Univ., Livermore. Lawrence Livermore Lab.
MODELING OF TRANSPORT IN THE TWO-DIMENSIONAL ATMOSPHERIC TRANSPORT AND KINETICS CODES SPHERNEW AND TRACER
Arthur Edwards 23 Jul. 1976 31 p refs
(Contract W-7405-eng-48)
(UCID-17203) Avail: NTIS HC A03/MF A01

The description includes the equations for transport by a specified velocity field, the eddy diffusion approximation for short-term fluctuations in the velocity, other simplifying approximations, the geometric grid, the difference equations, and the coefficient matrix of the grid. The assumption of a constant vertical density distribution was used to derive mass-consistent forms of the difference equations. ERA

N77-20672# Battelle Pacific Northwest Labs., Richland, Wash.
TRANSPORT MODELING IN THE ENVIRONMENT USING THE DISCRETE-PARCEL-RANDOM-WALK APPROACH
S. W. Ahlstrom and H. P. Foote Apr. 1976 6 p refs Presented at the EPA Conf. on Water Quality Modeling, Cincinnati, Ohio, 20-22 Apr. 1976
(Contract E(45-11)-1830)
(BNWL-SA-5528; Conf-760407-4) Avail: NTIS HC A02/MF A01

The latter approach is used in the formulation of the discrete-parcel-random-walk (DPRW) transport model. Each parcel has associated with it a set of spatial coordinates as well as a set of discrete quantities of mass and energy. A parcel's movement is assumed to be independent of any other parcel in the system. A Lagrangian scheme is used for computing the parcel advection, and a Markov random walk concept is used for simulating the parcel diffusion and dispersion. The DPRW technique is not subject to numerical dispersion, and it can be applied to three dimensional cases with only a linear increase in computation time. A wide variety of complex source/sink terms can be included in the model with relative ease. Examples of the model's application in the areas of oil spill drift forecasting, coastal power plant effluent analysis, and solute transport in groundwater systems are presented. ERA

N77-20673# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
INVESTIGATION OF THE BURSTING PROCESS IN AN ATMOSPHERIC BOUNDARY LAYER USING ACOUSTIC METHODS
J. F. Schubert and D. W. Pepper 1976 6 p refs Presented at Symp. on Atmospheric Turbulence, Diffusion, and Air Quality, Raleigh, N. C., 19 Oct. 1976
(Contract AT(17-2)-1)
(DP-MS-76-5; Conf-761003-10) Avail: NTIS HC A02/MF A01

An acoustic sounder was used to investigate the atmospheric boundary layer to determine the conditions under which atmospheric momentum bursting occurs. Preliminary sounder data show an abrupt transition from a laminar to a turbulent boundary

layer and gravity-wave generation due to shear instability. Data from the acoustic sounder and tethered balloons carrying radiotelemetry were compared to meteorological data obtained at 10 and 137 m on a meteorological tower. Initial sounder data also show that the conditions for the onset of the momentum burst phenomena exist periodically during clear afternoon when heat flux changes sign and the surface begins to cool. ERA

N77-20674# Kiruna Geophysical Inst. (Sweden).
KIRUNA GEOPHYSICAL DATA Data Summary, Jan. - Mar. 1976
G. Gustafsson, ed. 1976 51 p
(Rept-76/1-3) Avail: NTIS HC A04/MF A01

Results are presented of ground measurements of upper atmosphere parameters in regard to geomagnetism, optical aurora, ionospheric ionization, and radio wave propagation. ESA

N77-20675# National Oceanic and Atmospheric Administration, Boulder, Colo. Air Resources Lab.
SURFACE OZONE IN ANTARCTICA
Samuel J. Oltmans and Walter D. Komhyr Jul. 1976 604 p refs
(PB-260451/0; NOAA-TM-ERL-ARL-56; NOAA-76090801) Avail: NTIS HC A99/MF A01 CSCL 04A

Surface ozone observations gathered during a 13-year period in Antarctica are presented in the form of hourly mean values. In addition, summary data in the form of daily averages, daily maxima, monthly averages for each hour of the day, and a monthly mean are included in the printed data. A variety of instruments were used in making the observations. The principle of operation and calibration techniques for each type of instrument are described. The data reveal a strong annual cycle, no significant diurnal variation, and day-to-day variations probably associated with variations in the low-level thermal structure and changes in synoptic scale weather patterns. GRA

N77-20676# Center for the Environment and Man, Inc., Hartford, Conn.
REGIONAL VARIATIONS OF SOLAR RADIATION WITH APPLICATION TO SOLAR ENERGY SYSTEM DESIGN, USER'S MANUAL
Marshall A. Atwater and John T. Ball Jul. 1976 60 p refs (Grant NSF AER-75-14536)
(PB-259378/8; CEM-4185-550b; NSF/RA-760197) Avail: NTIS HC A04/MF A01 CSCL 04A

Derived data consisting of hourly values of total and direct-beam solar radiation, temperature, dew point, wind speed, wind direction, and infrared radiation are stored on magnetic tape for use in the design and analysis of solar heating (cooling) systems. The radiation data are derived from surface meteorological observations using a radiation model. GRA

N77-20677# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE NO. 4, SUMMARY REPORT 1975
James A. Watkins Aug. 1976 138 p refs Sponsored by Dept. of Commerce
(PB-261465/9; NOAA-76100602) Avail: NTIS HC A07/MF A01 CSCL 04A

The National Science Foundation opened the new South Pole Station in early 1975 and closed the old Station that was built in 1957. Automatic data acquisition systems (ICDAS) were installed at all four GMCC observatories. These systems log the data on magnetic tapes which are shipped to the GMCC offices in Boulder for processing. In the area of measurement techniques, noteworthy accomplishments were the development of a through-the-analyzer flask exposure system and the acquisition of three nephelometers to complete the requirements for such measurements at the four observatories. GRA

N77-20678# National Center for Atmospheric Research, Boulder, Colo.
ATLAS OF THE GLOBAL DISTRIBUTION OF TOTAL OZONE, JULY 1957 - JUNE 1967
Julius London (Colo. Univ., Boulder), Rumen D. Bojkov (World Meteorological Organization), Samuel J. Oltmans (NOAA, Washington, D. C.), and Jean I. Kelly Jan. 1976 282 p refs Sponsored in part by DOT
(Grants NSF GP-3196; NSF GA-10838; NSF GA-38134; NSF GA-28688)
(PB-258882/0; NCAR-TN-113) Avail: NTIS HC A13/MF A01 CSCL 04A

The data used for the analysis are the observations derived from the global ozone network. The mean seasonal and geographic ozone variations are discussed, and it is suggested that the distributions and variance of the data are significantly related to observed patterns of the general circulation. GRA

N77-20679# Phoenix Corp., McLean, Va.
INTERPOLATION OF GRAVITY ANOMALIES AND DEFLECTION OF THE VERTICAL COMPONENTS FROM RAPID GRAVITY SURVEY SYSTEM DATA
Jul. 1976 46 p refs
(Contract DAAG53-76-M-5907)
(AD-A031669; ETL-0075) Avail: NTIS HC A03/MF A01 CSCL 08/5

In this report numerical tests were conducted to: (1) evaluate the capability of the Rapid Geodetic Survey System RGSS in determining gravity anomalies and the deflecton of the vertical, and (2) utilize RGSS data type in combination with other gravity data to assess the accuracy of 1 deg x 1 deg mean anomalies for a test area. A theoretical 1 deg x 1 deg area was developed resembling closely an actual RGSS area for which gravity anomalies were computed along n traverses. Observed gravity data were used to derive 1 deg x 1 deg mean anomalies using the above techniques. In conclusion, the RGSS is a good instrument to be used in the measurement of gravity, however, the RGSS did not prove to be a viable instrument in the deflection of the vertical measurements. Author (GRA)

N77-20680# Air Force Geophysics Lab., Hanscom AFB, Mass.
MONTHLY MIDLATITUDE ATMOSPHERES, SURFACE TO 90 KM Environmental Research Papers
Arthur J. Kantor and Allen E. Cole 23 Jun. 1976 31 p refs (AF Proj. 8624)
(AD-A030740; AFGL-TR-76-0140; AFGL-ERP-572) Avail: NTIS HC A03/MF A01 CSCL 04/1

Sets of mean monthly Reference Atmospheres that reflect the seasonal changes in the vertical distributions of temperature, pressure, and density at altitudes up to 90 km are presented for latitudes 30 deg N and 45 deg N. Estimates of the magnitude of the diurnal, day-to-day, and spatial variability of temperature and density are included for altitudes above 20 km. Special attention is given to the distribution of atmospheric density since density is the atmospheric property of most concern to aerospace designers and engineers. This report is part of a comprehensive effort to develop sets of mean monthly atmospheric models, surface to 90 km, for 15 deg intervals of latitude from pole to equator. The research is being performed to help satisfy the many requests that have been received from Air Force engineers and designers for information on the time and space variability of atmospheric density and temperature at altitude up to 90 km. Author (GRA)

N77-20681# Kaman Sciences Corp., Colorado Springs, Colo.
HIGH ALTITUDE ATMOSPHERIC RADIATION TRANSPORT CALCULATIONS Final Report
James C. Eamon Kirtland AFB, N. Mex. AFWL Aug. 1976 64 p refs
(Contract F29601-76-C-0058; AF Proj. 8809)
(AD-A030817; AFWL-TR-76-142) Avail: NTIS HC A04/MF A01 CSCL 04/1

This report contains the results of MORSAIR code Monte Carlo calculations of neutron and secondary gamma transport in a real two-dimensional variable density atmosphere. These data were generated so that an assessment could be made of the adequacy of mass integral scaling of uniform air calculations in defining radiation environments in the atmosphere. Unclassified fission and thermonuclear source spectra were used in the calculations at source altitudes from 5 to 80 kilometers. Silicon and tissue doses as well as the total fluences were calculated for both neutrons and secondary gammas. GRA

N77-20682# Air Force Geophysics Lab., Hanscom AFB, Mass.
IONIZATION GAUGE MEASUREMENTS OF ATMOSPHERIC DENSITY FROM A LOW ALTITUDE SATELLITE Environmental Research Papers, Nov. 1974 - Jan. 1975
J. P. McIsaac, K. S. W. Champion, R. E. McInerney, and D. Delorey 24 May 1976 488 p refs
(AD-A032373; AFGL-TR-76-0113; AFGL-ERP-560) Avail: NTIS HC A21/MF A01 CSCL 04/1

Results obtained from an Air Force Satellite launched in the fourth quarter of 1974 are presented. Ionization gauge measurements of atmospheric density were performed, and the values obtained from these measurements are presented in two appendices in the form of density vs altitude and time plots. The method of data reduction its application is developed and discussed. The reduction technique differs from previously used techniques in that it is more suitable for the processing of large data files such as those obtained from satellite flights, as well as featuring a lessened dependence upon attitude determination. The experiment is also described and the theory of operation is given. Author (GRA)

N77-20683# California Univ., Berkeley. Earthquake Engineering Research Center.
STABILIZATION OF POTENTIALLY LIQUEFIABLE SAND DEPOSITS USING GRAVEL DRAIN SYSTEMS
H. Bolton Seed and John R. Booker Apr. 1976 65 p refs
(Grant NSF ENV-75-21875)
(PB-258820/0; EERC-76-10) Avail: NTIS HC A04/MF A01 CSCL 08M

A simplified theory which provides a convenient basis for evaluating the possible effectiveness of a gravel drain system is described. Where appropriate, additional analyses may readily be made using the computer program LARF, but for most practical cases, it is believed that the results presented in chart form will provide an adequate basis for design and selection of a suitable drain system for effective stabilization of potentially liquefiable sand deposits. GRA

N77-20684# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Data Service.
UNITED STATES EARTHQUAKES, 1974
Jerry L. Coffman and Carl W. Stover 1976 131 p refs Prepared in cooperation with Geological Survey, Washington, D. C.
(PB-260697/8; NOAA-76101912) Avail: NTIS HC A07/MF A01 CSCL 08K

Earthquakes are listed chronologically in 11 regions, an arrangement selected principally to highlight natural seismic divisions. Instrumental data used by the U.S. Geological Survey to compute earthquake epicenters is described. Each description includes pertinent instrumental date (data, origin time, geographic location, and depth, when available), a brief account of the area affected, and reported effects on people and inanimate objects. GRA

N77-20685# Lamont Geological Observatory, Palisades, N. Y.
LONG-PERIOD SEISMOLOGICAL RESEARCH PROGRAM Final Report, 15 Mar. 1971 - 30 Apr. 1976
Lynn R. Sykes and Donald W. Forsyth 30 Jun. 1976 63 p refs
(Contract F44620-71-C-0082; ARPA Order 1827)
(AD-A029667; AFOSR-76-0932TR) Avail: NTIS HC A04/MF A01 CSCL 17/10

During the first year of the subject contract, five high-gain, long-period (HGLP) seismograph stations were maintained and a sixth station was installed and maintained. Research completed under this contract included investigation into the characteristics of long-period earth noise, the detection capabilities of the high-gain stations, digital signal enhancement techniques, and new methods of distinguishing earthquakes from underground explosions, as well as several studies in general seismology using high-gain data. A detailed study of earth noise at all 11 HGLP sites found that the spectra of earth noise at each site is characterized by a minumum in the period range 25 to 45 seconds. The level of earth noise recorded by vertical seismographs is independent of local meteorological conditions, but at shallow sites, the earth noise levels recorded by horizontal seismographs exhibit a diurnal cycle associated with daily variations of atmospheric turbulence. The horizontal earth noise associated with atmospheric turbulence is attenuated by overburden to about 10% of the surface noise level at a depth of about 150 m. A new surface wave magnitude scale based on the amplitude of higher-mode Rayleigh waves was developed and applied to earthquakes and explosions in central Asia. In other investigations, surface waves were used to study the focal mechanism of small magnitude events, the pulse distortion of body waves travelling non-minimum time paths was computed, and the use of seismograph arrays in determining earth structure was examined. GRA

N77-20686# Naval Intelligence Support Center, Washington, D.C.
OPTICS OF THE OCEAN AND ATMOSPHERE
K. S. Shifrin, ed. 15 Jul. 1976 38 p refs Transl. into ENGLISH from the book "Optika okeana i atmosfery" Leningrad, Nauka Publishing House, 1972 p 4-24, 113-125, 181-187
(AD-A031347; NISC-Trans-3824) Avail: NTIS HC A03/MF A01 CSCL 20/6

'Contents' Basic relationships between hydrooptical characteristics--parameters of the light field in the sea and hydrooptical characteristics; Objective hydrospectronephelometer for in situ measurements of optical characteristics of seawater; Two methods of measuring spectral coefficients of light transmission through seawater layers of considerable thickness; Classification of Pacific Ocean waters according to transparency. GRA

N77-20687# Aeronautical Research Associates of Princeton, Inc., N. J.
STATUS REPORT ON A LOW-LEVEL ATMOSPHERIC TURBULENCE MODEL FOR MARINE ENVIRONMENT Final Report, 5 Sep. 1975 - 4 Sep. 1976
W. S. Lewellan, G. G. Williamson, D. A. Oliver, and M. E. Teske Sep. 1976 83 p refs
(Contract N00019-76-C-0142)
(AD-A030856; ARAP-289) Avail: NTIS HC A05/MF A01 CSCL 04/2

Two major modifications to A.R.A.P.'s program for computing the detailed low-level atmospheric distributions of velocity, temperature, moisture, refractive index, and the turbulent variances of these quantities for marine environments are described. The dimensions of the program have been extended to a two-dimensional, unsteady calculation to permit prediction of shoreline conditions developing in time. Also, a thermal radiation model has been incorporated into the one-dimensional model to permit the radiative flux divergence term to be computed in a fully coupled manner. Sample calculations have been made both to verify that the program behaves in a reasonably physical manner and to exemplify some of the types of boundary layer distributions which may be expected to occur. The coupled thermal radiation model was used to make calculations of the typical diurnal variations in the boundary layer over both land and water. The time variation of the boundary layer's stability is quite different over water than it is over land. This leads to sea-breeze circulations in the coastal planetary boundary layer which are exemplified in calculations using the two-dimensional, unsteady version of the model. Author (GRA)

N77-20688# Australian National Univ., Canberra. School of Earth Sciences.
SOLITARY WAVES IN THE ATMOSPHERE Interim Report, period ending 30 Jun. 1976
D. R. Christie, K. J. Muirhead, and A. L. Hales 1 Aug. 1976 61 p refs
(Grant AF-AFOSR-2759-75; AF Proj. 6799)
(AD-A031228; AFOSR-76-1133TR) Avail: NTIS HC A04/MF A01 CSCL 04/2

This report presents a description and interpretation of an unusual type of isolated atmospheric gravity wave observed near Tennant Creek in central Australia. Comparison of experimental data with theory shows that waves of this type belong to a new class of deep fluid internal solitary wave discovered by Benjamin and by Davis and Acrivos. An interesting feature of these solitary waves is that they mark the onset of significant atmoshperic turbulence. It is proposed that the following source mechanisms play an important role in the creation of solitary atmospheric waves in the arid interior of Australia: (1) the impulsive interaction of an intense thunderstorm downdraft or

downdraft generated gravity current with an inversion; (2) the interaction of nocturnal katabatic flow with an existing radiation inversion; and (3) the interaction of stationary gravity lee waves or standing eddies with a developing nocturnal inversion following a reversal in the the circulation over an orographic feature.
Author (GRA)

N77-20689# National Bureau of Standards, Washington, D.C. Physical Chemistry Div.
APPLICATION OF QUANTUM CHEMISTRY TO ATMOSPHERIC CHEMISTRY Annual Report, FY 1976
M. Krauss, F. H. Mies, D. Newmann, and P. S. Julienne Oct. 1976 19 p refs
(AF Proj. 9767)
(AD-A031322; AFOSR-76-1127TR) Avail: NTIS HC A02/MF A01 CSCL 04/1

Excitation of nitrogen and oxygen molecules is the primary event in the excitation of the atmosphere. Theoretical calculations of the electronic properties of these molecules required for the prediction of optical emissions from normal and disturbed atmospheres have been made, including the analysis of the electronic structure of excited states of nitrogen. Author (GRA)

N77-20690# Danish Meteorological Inst., Copenhagen.
BEHAVIOR OF AURORAL ZONE TOTAL ELECTRON CONTENT DURING SUBSTORMS
Ib Steen Mikkelsen and K. Damgaard Hanscom AFB, Mass. AFGL 3 Sep. 1976 15 p refs
(Grant AF-AFOSR-2161-72; AF Proj. 4643)
(AD-A031314; AFGL-TR-76-0235) Avail: NTIS HC A02/MF A01 CSCL 04/1

The auroral zone total electron content TEC as computed from the ATS-3 Faraday-rotation shows systematic changes during magnetic activity. These changes depend upon local time, season, sunspot-cycle and the prehistory of the magnetic activity. During summer and equinox the daytime TEC both shows a positive and negative phase, which probably are related to the prehistory of the magnetic activity. During winter the daytime TEC is dominated by enhancements as responses to the substorms. The magnitude of these enhancements is determined by the activity prior to sunrise. Thus if the activity is low prior to sunrise, the substorms during the subsequent day cause the TEC to blow up. In contrast if the pre-sunrise activity is high the daytime TEC is similar to the quiet time level. In the late afternoon the TEC is depleted at all seasons as a response to the substorms. in the night enhancements are observed due to the precipitation of substorm-injected electrons. These enhancements are very large during winter. During summer other factors cause a depletion of TEC. At sunspot maximum the net result is a depletion and at sunspot minimum an enhancement.
Author (GRA)

N77-20691# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
ON THE ROLE OF CHARGE EXCHANGE IN GENERATING UNSTABLE WAVES IN THE RING CURRENT Interim Report
John M. Cornwall 5 Oct. 1976 43 p refs
(Contract F04701-76-C-0077)
(AD-A031362; TR-0077(2260-20)-1; SAMSO-TR-76-211)
Avail: NTIS HC A03/MF A01 CSCL 04/1

The role of charge exchange in generating anisotropy in the ring current during recovery phase inside the plasmapause is explored. A simplified scenario is studied, in which the anisotropy evolves from an initially isotropic distribution. Other cases may be easily studied by shifting the time axis. When the anisotropy becomes large enough, the proton ring current just inside the plasmapause will emit ion electromagnetic cyclotron waves (which can cause SAR arcs by electron heating), with subsequent destruction of anisotropy in the wave-emission process. As long as finite-amplitude waves are present, gain and loss of anisotropy will be in rough equilibrium, and the pitch-angle distribution will no longer evolve as it would if only charge exchange were operating. The amount of energy lost to the waves is related to the charge-exchange loss rate with the aid of quasi-linear moment equations; it seems to be adequate to power SAR arcs. The role of heavy ions is considered; generally, these ions tend to damp the proton-generated waves. This damping is quite sensitive to the very-low-energy portion of the heavy-ion distribution function, but not to the thermal component. If the heavy-ion fraction at beginning of recovery phase is less than or equal to 0.2 proton EMC waves will most likely not be generated by charge exchange beginning from initial isotropy. Author (GRA)

N77-20692# Rome Air Development Center, Griffiss AFB, N.Y.
SHEMYA TROPOSPHERIC REFRACTION ERRORS
Edward Malowicki and Patrick R. Hoffman Aug. 1976 46 p refs
(AF Proj. 6512)
(AD-A030780; RADC-TR-76-202) Avail: NTIS HC A03/MF A01 CSCL 17/9

An attempt was made to characterize the Shemya, Alaska, troposphere to determine the tropospheric refraction errors in range and angle. Subsequently, various correction methods for these errors were investigated for a radar based at Shemya, Alaska, and operating at low elevation angles of 0 deg to 2.5 deg. The troposphere was characterized in terms of refractivity N profiles which were derived from airborne refractometer measurements made over a two-week period in June 1973. A cessna 310 mounted refractometer of the Vetter-Thompson type was used. The range and angle shifts and their standard deviations that the Shemya radar would experience due to this troposphere were determined by computer ray tracing through a spherically stratified troposphere. The average shifts varied from about 330 feet to 150 feet in range and from about 8 mr to 4 mr angle as the elevation angle increased from 0 deg to 2.5 deg and out to a 300 NM range. The corresponding standard deviations varied from about 10 feet to 7 feet in range and from about 1 mr to .2 mr in angle. Three correction methods are considered. The best correction method was found to be that based on the linear model. GRA

N77-20693# Stanford Research Inst., Menlo Park, Calif.
DNA PROJECT 609 RADAR: AURORAL BACKSCATTER MEASUREMENTS Final Report, 31 Jan. 1974 - 30 Sep. 1975
R. T. Tsunoda, R. I. Presnell, and T. N. C. Wang Feb. 1976 56 p refs
(Contract DNA001-72-C-0179; DNA Proj. NWET-L25AAXHX361; SRI Proj. 2001)
(AD-A031103; DNA-3929F) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report summarizes the research results obtained from auroral backscatter studies using the DNA 609 radar system located at Homer, Alaska. The primary purpose of the backscatter studies was to improve understanding of the auroral-clutter-producing mechanism. Most of the results are based on coordinated experiments utilizing the 398-MHz phased-array radar at Homer, the SRI/DNA incoherent-scatter radar at Chatanika, and other complementary auroral measurement techniques. It was found that the problem can be most effectively approached by seeking both microscale and macroscale relationships--i.e., the relationships of local plasma parameters within the radar scattering volume producing auroral clutter, and the relationships of the large-scale auroral and magnetospheric conditions to the spatial distribution of auroral clutter, respectively. The results include the following: (1) Diffuse auroral clutter is apparently not produced by primary plasma waves generated by the Buneman-Farley two-stream instability. (2) The mechanism does not, however, appear to be unlike the quasilinear gradient-drift instability model proposed by Sudan et al. (1973), which can be driven by the primary two-stream waves. (3) There is a threshold electric field strength of 30 mV/m associated with the occurrence of 398-HMz diffuse auroral clutter. (4) The diffuse auroral clutter is closely associated with the auroral electrojets. (5) The evening diffuse auroral clutter is closely associated with downward field-aligned currents. (6) Discrete auroral clutter is closely associated with the discrete visual aurora. GRA

N77-20694# Systems Science and Software, La Jolla, Calif.
TELESEISMIC COUPLING FROM THE SIMULTANEOUS DETONATION OF AN ARRAY OF NUCLEAR EXPLOSIONS
J. T. Cherry, T. C. Bache, W. O. Wray, and J. F. Masso 10 Feb. 1976 31 p refs
(Contract F08606-75-C-0045; ARPA Order 2551)
(AD-A031268; SSS-R-76-2865) Avail: NTIS

HC A03/MF A01 CSCL 18/3

Calculations performed to date have produced no significant enhancement of teleseismic ground motion from a multiple shot array. This was true in spite of the fact that the near source fracture pattern from the array differed significantly from that produced by a spherically symmetric explosion source. Fairly large perturbations in the seismic radiation pattern did appear but at frequencies outside the teleseismic band. Enhanced tension failure did occur in the multiple shot calculation. However, for this to seriously affect teleseismic ground motion it would require an explosive spacing, yield and material properties combination in which fracturing from the array is much greater than that produced by a single charge of equivalent yield. An array in which the important parameters are optimized to significantly alter the teleseismic ground motion could probably be constructed. However, it is much more likely that anomalous observations of teleseismic ground motion from an explosive array are due to overburden efeects and high (low) coupling material properties. If these factors fail to explain the anomaly, shock interaction calculations should be performed but should be based on a good estimate of material strength for the rock at the test site. Author (GRA)

N77-20695# Systems Science and Software, La Jolla, Calif.
PREDICTION AND MATCHING OF TELESEISMIC GROUND MOTION (BODY AND SURFACE WAVES) FROM THE NTS MAST EXPLOSION
T. G. Barker, T. C. Bache, J. T. Cherry, N. Rimer, and John M. Savino 6 Feb. 1976 67 p refs
(Contract F08606-75-C-0045; ARPA Order 2551)
(AD-A031269; SSS-R-76-2727) Avail: NTIS HC A04/MF A01 CSCL 18/3

This report presents the results of a theoretical prediction of the teleseismic body and surface wave signatures of the NTS underground explosion, MAST, and a detailed comparison of the predicted waveforms with seismograms recorded at stations of the Special Data Collection System (SDCS). This study involves a comprehensive analysis of the MAST explosion, including computer modeling of the close-in nonlinear ground motion produced by this event, propagation of the resultant stress waves through the appropriate earth structures and computation of seismograms recorded at designated teleseismic stations. Comparison of theoretical and observed short- and long-period seismograms were made with respect to amplitude, waveform and travel time. Travel times were closely matched as were the waveforms for surface waves. For body waves a number of the SDCS stations are within the triplication range and the waveform match is far from ideal. Still, amplitudes for both body and surface waves were matched to within 50 percent and were much closer in most cases. Author (GRA)

N77-20696# Oregon State Univ., Corvallis. Water Resources Research Inst.
HYDRAULIC FUNCTIONS OF SOILS FROM PHYSICAL EXPERIMENTS AND THEIR APPLICATIONS Final Report
R. H. Brooks and Charles Su 1 May 1976 141 p refs Sponsored by Office of Water Res. and Technol.
(PB-259547/8; WRRI-41; W77-00667;
OWRT-C-5270(4218)(1)) Avail: NTIS HC A07/MF A01 CSCL 08M

Based upon the Pearson Type VIII distribution function, a general retention function which relates the saturation to the capillary pressure in disturbed soils was discovered. This simple and yet complete function was shown to describe precisely the imbibition as well as the drainage branch of the retention curve. It is defined by four readily assessed parameters that either have physical significance themselves or are used to determine some hydraulic properties of the soil. With the assumption that the Burdine integrals are adequate, a relative permeability function was derived through the substitution of the retention function for the inegrands in the Burdine integrals. GRA

N77-20697# National Oceanic and Atmospheric Administration, Rockville, Md. Federal Coordinator for Geodetic Control and Related Surveys.
SPECIFICATIONS TO SUPPORT CLASSIFICATION, STANDARDS OF ACCURACY, AND GENERAL SPECIFICATIONS OF GEODETIC CONTROL SURVEYS
John O. Phillips Jul. 1976 37 p refs
(PB-261037/6; NOAA-S/T-76-1803; NOAA-76100402) Avail: NTIS HC A03/MF A01 CSCL 08B

The Classification and Standards of Accuracy provide the permissible tolerances for the indicated order and class of control. These Specifications provide the guidance to obtain (for horizontal control) the specified strength of figure, spacing of Laplace azimuths, number of observations, triangle closures, length checks, and station spacing, and (for vertical control) the line spacing, field procedures and section closures to be followed to satisfy the standards. They are a directive for surveys that are to be assimilated into or considered a part of the National Geodetic Control Networks. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-20698*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DATA FOR NASA'S AVE 5 EXPERIMENT: 25 mb SOUNDING DATA AND SYNOPTIC CHARTS
Mark E. Humbert and Kelly Hill (Texas A and M Univ., College Station, Tex.) Feb. 1977 217 p refs
(NASA-TM-X-73370) Avail: NTIS HC A10/MF A01 CSCL 04B

The AVE V Experiment is described and tabulated rawinsonde data at 25-mb intervals from the surface to 25 mb for the 23 stations participating in the experiment are presented. Soundings were taken between 0000 GMT, June 11, and 1200 GMT, June 12, 1976. The methods of data processing and accuracy are briefly discussed. An example of contact data is also included. Author

N77-20699# Brookhaven National Lab., Upton, N.Y.
STUDY OF THE TRANSPORT AND DIFFUSION CLIMATOLOGY OF THE US EAST COAST
G. S. Raynor and J. V. Hayes 1976 2 p refs Presented at Conf. on Coastal Meteorology, Virginia Beach, Va., 21 Sep. 1976
(Contract E(30-1)-16)
(BNL-21601; Conf-760918-4) Avail: NTIS HC A02/MF A01

The transport and diffusion climatology of the entire U.S. east coast are described so that potential sites can be compared before selection. The data also give guidance in planning for routine operation and possible accident situations after a site is chosen. Actual and proposed installations include both floating and shore-based nuclear power plants, fossil-fueled power plants, industries and refineries. Activities include oil drilling, fuel transport and movement of hazardous materials. ERA

N77-20700# Danish Meteorological Inst., Copenhagen.
UNMANNED GEOPHYSICAL OBSERVATORIES IN NORTH GREENLAND, 1972 - 1975
Gunnar Jensen (Res. Estab. Riso), Leif Kristensen (Res. Estab. Riso), P. Dorph-Petersen, and Joergen Taagholt 1976 93 p refs
(ISBN-87-7478-121-9) Avail: NTIS HC A05/MF A01

Meteorological measurements at three Unmanned Geophysical Observatories (UGO) installed at station Nord, Kap Harald Moltke, and Kap Norris Jesup are reported. An account is given of the experience with the UGO systems, the instrumentation including a datalogger, a temperature sensor system, anemometer, wind direction sensor, the modifications and improvements made as well as processing of the climatological data. ESA

N77-20701# Royal Netherlands Meteorological Inst., De Bilt.
SUMMERS IN THE NETHERLANDS SINCE 1706 FROM A THERMAL POINT OF VIEW [DE ZOMERS IN NEDERLAND VANAF 1706 THERMISCH BEKEKEN]
F. IJnsen 1976 38 p refs In DUTCH; ENGLISH summary
(KNMI-WR-76-15) Avail: NTIS HC A03/MF A01

A method is described for the classification of all summers since the year 1706 in the Netherlands based on their thermal

character. A summer number (S) was developed using mean temperatures of the periods May through September (Tw), June through August (Tz) and the mean temperature of the warmest month (Tm) according to the formula: S = 7.58 Tw + 6.24 Tz + 4.95 Tm - 249.7. These numbers form a time series which was investigated statistically. A weak indication was found that summers in odd numbered years are warmer than in even numbered years, especially as regards the last century. ESA

N77-20702# Royal Netherlands Meteorological Inst., De Bilt.
FORECASTS OF MONTHLY AVERAGE TEMPERATURE USING TRANSITIONAL RULES [VERWACHTINGEN VAN DE MAANDGEMIDDELDE TEMPERATUUR M.B.V. OVERGANGSREGELS]
H. M. VanDenDool 1976 28 p refs In DUTCH; ENGLISH summary
(KNMI-WR-76-14) Avail: NTIS HC A03/MF A01

The interrelationship between monthly mean temperatures (T30) in De Bilt was used to derive forecast rules of a purely statistical nature. Knowing the value of T30 of the previous month makes it possible to indicate a range of temperatures for the following month which are more likely to occur than may be expected on the basis of climatology only. Such ranges of temperatures can be found by comparing the climatological and conditional frequency-distributions of T30. These frequency distributions were computed from the Labryn dataset (1735-1944) extended to 1975. The forecast rules reflect mainly persistence, which is highest during late winter and late summer. During the transitional months nothing better than climatological forecasts can be given. Averaged over the year forecasts of T30, of this statistical nature, are 5 to 7% better than climatological probability. Author (ESA)

N77-20703# Royal Netherlands Meteorological Inst., De Bilt.
CRITERIA FOR REJECTING OBSERVATIONS IN AN OBJECTIVE ANALYSIS [KRITERIA VOOR HET VERWERPEN VAN WAARNEMINGEN IN EEN OBJEKTIEVE ANALYSE]
J. VanMaanen 1976 14 p refs In DUTCH
(KNMI-V-279) Avail: NTIS HC A02/MF A01

Criteria for recognition of erroneous data in the objective analysis of the altitude of a pressure level are dealt with. The procedure used consists of the establishment of a guess field using a numerical forecasting model. This guess field is based on observations carried out 12 hours beforehand. The guess field allows checking the probability that a certain observation is valid, and is also used later in the analysis procedure as first guess for the analysis, but this application is basically independent of the test procedure for the rejection/acceptation of stations. ESA

N77-20704# Royal Netherlands Meteorological Inst., De Bilt.
VERIFICATION OF THE BASE PRODUCT OF THE AMERICAN MONTHLY FORECAST [VERIFIKATIE VAN HET BASISPRODUKT VAN DE AMERIKAANSE MAANDVERWACHTING]
H. M. VanDenDool and J. L. Nap 1976 13 p refs In DUTCH
(KNMI-V-280) Avail: NTIS HC A02/MF A01

The reliability of the product, i.e., the forecast 700 mbar chart, of the American monthly forecast was verified. It was found that the forecast and observed H700 fields differ as much as the climatologically normal and the observed field in root mean square meaning. The correlation between forecast and observed H700 field is at most equal to the correlation between the climatologically normal and observed field. Observed anomalies in the 700 mbar field correlate weakly (+0.13) with forecast anomalies. The numerous laborious steps undertaken to compile the base product have little or no effect on the final weather forecast in the Netherlands at ground level. ESA

N77-20705# Stanford Research Inst., Menlo Park, Calif.
HEIGHT POSITIONING OF CLOUD-MOTION VECTORS FROM SATELLITE INFRARED TRACKING OVER GATE AREA Final Report
Paul A. Davis Aug. 1976 63 p refs
(Grant NOAA-5-3544; SRI Proj. 4431)
(PB-260454/4; NOAA-76091601) Avail: NTIS HC A04/MF A01 CSCL 04B

Sequences of infrared imagery from the SMS-1 satellite over the GATE (GARP Atlantic Tropical Experiment) area were used to define cloud tracks (corrected for satellite motion and orientation) in the proximity of stations with upper-air wind observations. For these tropical soundings, this result accounts for the apparent linear relationship (on the average) between the cloud radiometric temperature and its departure from the temperature of pertinent soundings. The study suggests that the best fit between winds and cirrus cloud motions in a given region is confined to a relatively thin layer, but the height of that layer may vary from one synoptic-geographic region to another. GRA

N77-20706# National Weather Service, Silver Spring, Md. Engineering Div.
DARDC WIND INTERFACE
Richard C. Ahlberg, Jr. Aug. 1976 22 p
(PB-260443/7; NOAA-TM-NWS-ENG-10; NOAA-76090904)
Avail: NTIS HC A02/MF A01 CSCL 04B

The Device for Automatic Remote Data Collection (DARDC) is described. Three outputs are available from this system: damped wind direction, one minute average wind speed, and one second peak wind gust. While the direction readout is available only in degrees, the speed and peak gust readouts are programmable for knots, kilometers per hour, miles per hour, or feet per second. The peak gust is reset after each interrogation of the DARDC. GRA

N77-20707# National Weather Service, Salt Lake City, Utah. Western Region.
OTHER KINDS OF WIND SHEAR
Christopher D. Hill Aug. 1976 20 p refs
(PB-260437/9; NOAA-TM-NWS-WR-108; NOAA-76090802)
Avail: NTIS HC A02/MF A01 CSCL 04B

Three types of wind shear associated with the airflow over mountain barriers were identified. The first two types of shear are induced by low level inversions while the third is caused by rotary activity beneath lee waves. Specific examples of the types of synoptic situations which produce the inversion iduced shears at the Reno airport were examined and used to substantiate the basic premises of types I and II shear. The effects of the different types of shears on aircraft operations have been examined with inferences as to possible ways of minimizing the potential hazards involved if a choice of runway orientation is available. GRA

N77-20708# Western Scientific Services, Inc., Fort Collins, Colo.
AN INVESTIGATION OF PRECIPITATING ICE CRYSTALS FROM NATURAL AND SEEDED WINTER OROGRAPHIC CLOUDS Final Report
Larry Vardiman and Curtis L. Hartzell Jun. 1976 142 p refs
(Contract DI-14-06-D-6644)
(PB-258718/6; SR-359-47) Avail: NTIS HC A07/MF A01 CSCL 04B

Ice crystal data were collected from 22 storms near Wolf Creek Pass for the period of February 1973 through March 1975. Additional data on ice nuclei and cloud-top temperatures were also obtained for the period. Analyses were performed on the crystal type, size, concentration, and the amount of rime under seeded and natural conditions. The storms were subdivided into three hour blocks based on sounding times. Changes in ice crystal characteristics were observed near Wolf Creek Pass when artificial nuclei were detected in and slightly upwind of the target area. GRA

N77-20709# Wyoming Univ., Laramie. Dept. of Atmospheric Science.
REPORT TO THE NATIONAL SCIENCE FOUNDATION RESEARCH APPLIED DIRECTORATE WEATHER MODIFICATION ASSOCIATION Final Report
August H. Auer, Jr. and Frank D. Eaton 30 Jun. 1976 46 p refs Prepared in cooperation with Stanford Res. Inst., Menlo Park, Calif.
(Grant NSF AEN-76-00898)
(PB-259029/7; NSF/RA-760255) Avail: NTIS HC A03/MF A01 CSCL 04B

The study attempts to make comparative observations of urban and nonurban environments to determine processes

responsible for differences in boundary layer signature, wind fields, and resultant convective cloud behavior, traceable to urban-induced changes in heat humidity and aerosols. GRA

N77-20710# National Climatic Center, Ashville, N. C.
HIGH ALTITUDE METEOROLOGICAL DATA. VOLUME 12, NUMBER 1: QUARTERLY ISSUE JANUARY-FEBRUARY-MARCH 1975
1 Apr. 1976 574 p
(PB-261481/6; NOAA-76101904-Vol-12-No-1) Avail: NTIS MF A01; HC avail. from National Climatic Center, Federal Bldg., Asheville, N. C. 28801, Attn: Publications CSCL 04B

Each metrocket report includes measured wind and/or temperature and computed values of pressure, density, speed of sound, and fall velocity for significant levels, constant pressure levels, and interpolated 1 kilometer intervals. Computed values are derived using the Hydrostatic and Gas Law equations. Also included with the metrocket report is a corawinsonde report used primarily to provide a base level for computing the metrocket thermodynamic data. GRA

N77-20711# Colorado International Corp., Boulder.
HIGH PLAINS COOPERATIVE PROGRAM CLOUD SURVEY AND SEEDING RESEARCH AIRCRAFT AND ASSOCIATED DATA PROCESSING Final Report, Jun. - Jul. 1976
R. T. Beaumont Sep. 1976 27 p Sponsored by Bur. of Reclamation, Denver
(PB-260397/5) Avail: NTIS HC A03/MF A01 CSCL 04B

An instrumented aircraft capable of seeding clouds with silver iodide and dry ice was operated over Miles City, Montana. Seeding systems included AgI-Nh4 acetone generators, wing and fuselage mounted racks for ejectable and burn-in-place AgI pyrotechnic flares. Dry ice (CO_2) in the form of small pellets were also released from the aircraft. Variable concentration and delivery methods were used to evaluate seeding materials and dispersion techniques. On onboard data system recorded cloud parameters during survey and seeding experiments. All flight observations of atmospheric data i.e. air temperature, dew point, pressure, indicated air speed, liquid water content, rate of climb were observed every 8.5 sec and recorded on computer compatible magnetic tape. GRA

N77-20712# National Oceanic and Atmospheric Administration, Boulder, Colo. Weather Modification Program Office.
A BRIEF COMPARISON OF SOME OF THE CONDITIONS ATTENDING HURRICANES CARMEN AND FIFI (1974)
Harry F. Hawkins (National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.) Jun. 1976 13 p refs
(PB-259590/8; NOAA-TM-ERL-WMPO-31; NOAA-76082305) Avail: NTIS HC A02/MF A01 CSCL 04B

A comparison of the high-level mass outflows (at 5 deg and 10 deg latitude radial distance from storm center) in the two hurricanes computed from 'satellite winds' reveals that the outflow from Hurricane Fifi was stronger by a factor of 2, presumably because it was a bigger, wetter storm. Resultant steering winds at five deg latitude from the center showed little value in indicating storm trajectory, but those at 10 deg latitude related better to storm motion, especially after removal of a bias that was fairly consistent. GRA

N77-20713# National Oceanic and Atmospheric Administration, Boulder, Colo. Weather Modification Program Office.
A STUDY OF THE STRUCTURE AND DYNAMICS OF THE SAHARAN AIR LAYER OVER THE NORTHERN EQUATORIAL ATLANTIC DURING BOMEX
Henry F. Diaz, Toby N. Carlson (Natl. Hurricane and Exptl. Meteorology Lab., Coral Gables, Fla.), and Joseph M. Prospero (Miami Univ., Coral Gables, Fla.) Jul. 1976 72 p refs
(Contract Nonr-4008(02); Grants NSF GA-31104; NSF GA-25916)
(PB-259591/6; NOAA-TM-ERL-WMPO-32) Avail: NTIS HC A04/MF A01 CSCL 04B

The 'Saharan air layer' (SAL) was investigated by means of conventional meteorological parameters and by aircraft measurements of the air-mass tracers, dust and radon-222. Analyses show that outbreaks of Saharan air reaching the Lesser Antilles are characterized by a uniform gradient of potential temperature and mixing ratio in the vertical, a relative absence of cumulus convection, and a high concentration of dust and radon. The upper surface of the SAL often has a dome- (or ridge-) like appearance; the dome is usually associated with the warmest air in the SAL. The depth of the SAL tends to decrease toward the boundary, where it is often relatively shallow. GRA

N77-20714# Kansas Water Resources Research Inst., Manhattan.
THE DESIGN OF AN INEXPENSIVE RAIN GAGE WITH BOTH AMOUNT AND RATE CAPABILITIES Completion Report, 1 Sep. 1975 - 30 Jun. 1976
Donald R. Hummels and Donald H. Lenhert Aug. 1976 79 p refs
(Contract DI-14-31-0001-6017)
(PB-258770/7; OWRT-A-073-KAN(1); W77-00160; Contrib-181) Avail: NTIS HC A05/MF A01 CSCL 04B

A prototype recording rain gage was built for less than $200. The prototype provides both rainfall rate and total rainfall data in a form which is computer compatible. The prototype operates on batteries in a remote location unattended for one month. The prototype uses a plastic tipping bucket to detect each .01 inch increment of rainfall. When an increment is detected, the time in month, day, hour, minute, and second given by a digital clock is stored in an inexpensive tape cassette storage system. A microprocessor-based system is used to recover the data. GRA

N77-20715# National Center for Atmospheric Research, Boulder, Colo.
PHYSICAL MECHANISMS RESPONSIBLE FOR THE MAJOR SYNOPTIC SYSTEMS IN THE EASTERN CANADIAN ARCTIC IN THE WINTER AND SUMMER OF 1973 Ph.D. Thesis - Colorado Univ., Boulder
Ellsworth Frank LdDrew 1976 220 p refs
(Contract NSF C-760)
(PB-258821/8; NCAR,CT-38) Avail: NTIS HC A10/MF A01 CSCL 04B

A diagnostic 3-D atmospheric model from which the total vertical velocity from 6 physical processes may be computed is designed and validated. These processes are: the differential advection of vorticity, the thickness advection, the release of latent heat, the effects of the surface enthalpy flux, and the influence of friction and orography at the surface. By partitionment of this diagnostic model (the omega equation) into the component vertical velocities the magnitude and relative importance of each process may be determined. GRA

N77-20716# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
EVALUATION OF TECHNIQUES FOR LONG-RANGE FORECASTING OF AIR TEMPERATURE AND ICE FORMATION
Jeffrey C. Rogers Jan. 1976 29 p refs
(PB-259695/5; NOAA-TM-ERL-GLERL-8; GLERL-Contrib-60; NOAA-76082304) Avail: NTIS HC A03/MF A01 CSCL 04B

Four techniques for making long-range air temperature forecasts were evaluated by using wintertime (November through February) data from around Lakes Superior, Huron, and Michigan. The four techniques analyzed were: (1) the use of cycles and oscillations, (2) the extrapolation and kinematic process used by the National Meteorological Center which results in forecasts in the Average Monthly Weather Outlook, (3) conditional probabilities, and (4) a Markov chain equation. GRA

N77-20717# National Oceanic and Atmospheric Administration, Washington, D.C. Center for Experiment Design and Data Analysis.
ANALYSIS OF IFYGL RAWINSONDE BASELINE MEASUREMENTS
Scott Williams Jul. 1976 18 p
(PB-259736/7; NOAA-TM-EDS-CEDDA-8; NOAA-76081302) Avail: NTIS HC A02/MF A01 CSCL 04B

Comparisons are made between factory and field baseline measurements of the rawinsonde instrumentation used during the International Field Year for the Great Lakes (IFYGL) in 1972 to 73. Manual thermometer readings under field conditions probably have a standard error of at least one-fourth of a graduation, or 0.25C for the U.S. IFYGL baseline thermometers. The precision sondes and individually calibrated sensors used

during IFYGL give temperatures with a standard error of 0.2C or less. GRA

N77-20718# National Weather Service, Kansas City, Mo.
METEOROLOGICAL EFFECTS ON THE DRIFT OF CHEMICAL SPRAYS
Jerry D. Hill (Natl. Weather Service, Lexington, Ky.) Jul. 1976 16 p refs
(PB-259593/2; NOAA-TM-NWS-CR-60; NOAA-76072201)
Avail: NTIS HC A02/MF A01 CSCL 04B

The problem of drift is a challenge to the meteorologist but the proper interpretation of appropriate weather information helps the applicator obtain the maximum effectiveness from his chemicals while minimizing contamination of our environmsnt. GRA

N77-20719# National Weather Service, Salt Lake City, Utah.
MAP TYPES AS AID IN USING MOS PoPS IN WESTERN US
Ira S. Brenner (Natl. Weather Service Forecast Office, Phoenix, Ariz.) Aug. 1976 20 p refs
(PB-259594/0; NOAA-TM-NWS-WR-107; NOAA-76082306)
Avail: NTIS HC A02/MF A01 CSCL 04B

The correlation between individual map types and the performance characteristics of Model Output Statistics (MOS) probability forecasts was investigated. The data sample used was June to August 1975 (summer season) and December to February 1976 (winter season). Brier scores and improvement ratios were computed for map type and MOS probability forecasts for various western United States stations for four 12-hour periods. With two exceptions, it was found that map types do not distinguish when more (or less) weight should be given to MOS PoP forecasts. GRA

N77-20720# Army Electronics Command, Fort Monmouth, N.J.
EXPERIMENTAL STUDY OF THE RELATIONSHIP BETWEEN RADIOSONDE TEMPERATURES AND RADIOMETRIC-AREA TEMPERATURES
Rufus E. Bruce, Louis D. Duncan, and Joseph H. Pierluissi Aug. 1976 21 p refs
(DA Proj. 1T1-62111-AH-71)
(AD-A030559; ECOM-5599) Avail: NTIS HC A02/MF A01 CSCL 04/2

A large sample of temperature observations was statistically analyzed to estimate horizontal temperature variability as a function of distance. These estimates were determined at several altitudes from the surface to 15 km and are applicable to horizontal distance up to 175 km. The results were used to assess the amount of disagreement one should expect when comparing radiosonde temperature measurements with corresponding measurements derived from satellite radiometric observations. The conclusion was that horizontal temperature variations over the radiometrically observed area contribute approximately 1K root mean square (rms) disagreement between such comparisons. When the separation distance between the radiosonde and satellite observation approaches 200 km, rms differences of greater than 2K are to be expected. Author (GRA)

N77-20721# Kentucky Univ., Lexington.
STATISTICAL MODELS FOR PRECIPITATION
Z. Govindarajulu, Peter Purdue, and Frank Cioch Aug. 1976 48 p refs
(Contracts DI-14-31-0001-5017; DI-14-34-0001-6018)
(PB-259270/7; W77-00537; OWRT-A-055-KY(1); RR-96)
Avail: NTIS HC A03/MF A01 CSCL 04B

Available data consist of daily rainfall for the past 24 years (1948-1972) for Lexington, Louisville and Paducah. For Ashland the data are available for the period of 40 years (1932-1972). The problem is to find an appropriate family of distributions indexed by a suitable number of parameters that fits the maximum daily rainfall. Further, there might be seasonal variations. The following seasons were considered: (1) Dry Convective season: August 1-October 30; (2) Early Convective season: May 1-July 31; and (3) Late Convective season: November 1-April 30. After extracting the yearly maximums for each of these seasons, fittings were made of three distributions for each station one for each season. GRA

N77-20722# Navy Electronics Lab., San Diego, Calif.
FOG RELATED TO STRATUS CLOUDS IN SOUTHERN CALIFORNIA. MULTISENSOR OBSERVATIONS OF FOG AND ANALYSIS OF MESOSCALE AND RADIOSONDE DATA PROVIDE EVIDENCE THAT RADIATIONAL COOLING FROM THE TOP OF STRATUS CLOUDS IS A SIGNIFICANT PROCESS LEADING TO FOG FORMATION AND THAT MESOSCALE VARIABILITY OF FOG PRODUCING MECHANISMS IS GREAT Research Report, Jan. 1974 - Dec. 1975
V. R. Noonkester and L. E. Logue 12 Aug. 1976 70 p refs (WR0330200)
(AD-A031241; NELC-TR-1989) Avail: NTIS HC A04/MF A01 CSCL 04/2

Many fog events have been observed at the coast of San Diego during the presence of a stratus-cloud deck using a set of remote (eg, FM-CW radar and acoustic echosounder) and direct (eg, radiosondes) atmospheric sensors. The sensor observations and analysis of mesoscale and radiosonde data provide evidence that radiational cooling from the top of the stratus clouds is a significant process leading to fog formation and that mesoscale variability of fog producing mechanisms is considerable. Author (GRA)

N77-20723# Utah Univ., Salt Lake City. Dept. of Meteorology.
STATISTICAL INFERENCE OF CLOUD THICKNESS FROM NOAA IV SCANNING RADIOMETER DATA Interim Report
William J. Kaveney, Robert Feddes, and Kuo-nan Liou Hanscom AFB, Mass. AFGL 5 May 1976 81 p refs
(Contract F19628-75-C-0107; AF Proj. 627A)
(AD-A031160; AFGL-TR-76-0105; Scientific-2) Avail: NTIS HC A05/MF A01 CSCL 04/2

A statistical correlation between cloud thickness and brightness is shown by regression analyses using the least square method. Cloud thickness are obtained from two sources; pilot reports and the Three-Dimensional Nephanalysis (3DNEPH) program for cases of single stratus and strato-cumulus layers. Brightness values are obtained from the NOAA IV satellite scanning radiometer. Regression analyses are performed on both thickness data sources used in conjunction with the scanning radiometer data. The results are shown by the regression curve relating pilot report thicknesses and brightness accounting for 66% (R sq = 0.66) of the variance between the variables, and the regression curve relating 3DNEPH thicknesses and brightness accounting for 46% (R sq = 0.46) of the variance between the variables. Moreover, in view of the effect of cloud compositions on the cloud brightness, regression analyses are performed on both thickness data sources excluding those cases whose origin is an unstable maritime tropical air mass. Results of these regression analyses reveal increases in the correlation between cloud thickness and brightness with 88% and 55% of the variances accounted for pilot reports and 3DNEPH program data sources, respectively. Author (GRA)

N77-20724# National Weather Service, Honolulu, Hawaii. Pacific Region.
AN EXPERIMENT IN THE PRODUCTION OF POP FORECASTS USING A STATISTICAL MODEL
G. Hirata Sep. 1976 19 p refs
(PB-260926/1; NOAA-TM-NWS-PR-15; NOAA-76100404)
Avail: NTIS HC A02/MF A01 CSCL 04B

The method used in producing precipitation forecasts and presents some of the results of the experiment are described. The computer program consisted of: a program for estimating the parameters in the logistic function (by maximum likelihood involving non-linear iterative techniques); and prediction of the probability of precipitation using estimated coefficients on current observed data. Independent parameters decided upon after testing were: Sea level pressure; temperature of the air; dew point; and the presence or absence of precipitation at the time of observation. GRA

N77-20725# National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service.
MARINERS WEATHER LOG, VOLUME 20, NO. 5
Elwyn Wilson Sep. 1976 62 p refs
(PB-261032/7; NOAA-76092304) Avail: NTIS

HC A04/MF A01 CSCL 04B

Computerized tropical cyclone climatology; Polar Star--new coastguard icebreaker; and National Weather Service marine data collection are the topics considered. GRA

N77-20726# Israel Meteorological Service, Bet Dagan.
STATISTICAL, METEOROLOGICAL AND DEPTH-AREA ANALYSIS OF RAINFALL Final Report
N. Rosenan, R. Markovitz, and Y. Shashua 1976 33 p refs (Contract E-4-67(N))
(PB-260578/0; NOAA-76090803) Avail: NTIS HC A03/MF A01 CSCL 04B

The program formulated provided statistical analysis of a long years (105 years) rainfall series and its application to hydrological middle-range and long-range forecasting: (1) the occurrence and disappearance of singularities; according to portions of the series (say, every 20 or 30 years), (2) fluctuations in the distribution of daily rainfall according to magnitude within the 105 years of record, and (3) conclusion. GRA

N77-20727# Naval Postgraduate School, Monterey, Calif.
A MICROPROGRAMMABLE DATA ACQUISITION AND CONTROL SYSTEM (MIDAS 2A) WITH APPLICATION TO MEAN METEOROLOGICAL DATA M.S. Thesis
John Russell Plunkett Sep. 1976 145 p refs
(AD-A032377) Avail: NTIS HC A07/MF A01 CSCL 09/2

The construction and operation of a fully automated microprogrammable data acquisition and control system (MIDAS IIA) with application to the sampling and mean averaging of meteorological data is reported. MIDAS IIA is designed to automatically collect periodic samples of various meteorological data in digital and analog forms, compute mean averages over selectable time intervals, and produce a permanent output record of the time averaged data. The system consists of a microprocessor based on the Intel Corp. 8008 CPU, a 16-channel multiplexed analog-to-digital converter, a digital clock, an incremental digital cassette tape recorder, numerous meteorological data sensors, and a teletype for input/output. Details of system operation and programming are described. Author (GRA)

N77-20728# Naval Research Lab., Washington, D.C.
A CRITICAL ANALYSIS OF CLIMATOLOGICAL WIND DATA USED IN THE FORECAST OF RADIOACTIVE DEBRIS CLOUD MOVEMENT
Mark R. Schoeberl and S. T. Zalesak Sep. 1976 39 p refs (NRL Proj. H02-36; DNA Proj. NWED-QAXHC065)
(AD-A031404; NRL-MR-3366) Avail: NTIS HC A03/MF A01 CSCL 04/2

Groves: (1969, 1972) climatological wind field data is critically examined for the purpose of forecasting radioactive debris cloud motion. It is found that the data base used by Groves is too sparse to be climatologically representative. We also find that the wind field given by Groves implies the existence of heat and momentum sources not believed to be present in the upper atmosphere, and furthermore, the wind fields are unstable to eddy perturbations. These results suggest that the climatological averaging process is biased by poor spatial and temporal resolution. Eddy motions are thus averaged as part of the mean flow. It is concluded that for the purpose of forecasting debris cloud motion, climatological wind fields are useful for producing idealized calculations but are probably not very representative of the actual wind fields at a given time and place. A better model for such purposes would be a theoretical forecast model initialized on a regular basis from satellite radiance data. Author (GRA)

N77-20729# Army Electronics Command, Fort Monmouth, N.J.
AN ALL DIGITAL AUTOMATED WIND MEASUREMENT SYSTEM
F. Taylor, P. Mohan, P. Joseph, and T. Pries Sep. 1976 33 p refs
(AD-A031439; ECOM-5801) Avail: NTIS HC A03/MF A01 CSCL 04/2

In addition to supplying basic meteorological information, vectored wind velocity measurements are essential to the analysis of small caliber ballistic trajectories, optical wave propagation in the lower atmosphere, and wind shears and vorticies. Conventional electromechanical methods, using velocity-to-direct current converters, are often unsatisfactory when integrated into a multisensor array over long path lengths. An all digital system capable of operating as an array over long path lengths has been developed. The system is totally automated. By use of complete metal oxidized semiconductors (CMOS) signal processing remote data acquistion stations, operated under microprocessor control, reliable and accurate asynchronous data transfer has been obtained. Author (GRA)

N77-20730# Army Electronics Command, Fort Monmouth, N.J.
APPLICATIONS OF EMPIRICAL CORRECTIONS TO NOAA-4 UTPR OBSERVATIONS
Louise D. Duncan and Mary Ann Seagraves May 1976 35 p refs
(DA Proj. 1T1-62111-AH-71)
(AD-A026085; ECOM-5593) Avail: NTIS HC A03/MF A01 CSCL 04/2

A technique for reducing the errors in atmospheric temperature profiles derived from infrared measurements taken by weather satellites is presented. A set of empirical corrections obtained by regression analyses was tested on independent samples. The results showed an overall decrease in the errors in the derived temperature profiles. Author (GRA)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-20731# Brookhaven National Lab., Upton, N.Y.
CONTROLLABLE REAL-TIME DATA COLLECTION SYSTEM FOR COASTAL OCEANOGRAPHY
D. G. Dimmler, D. W. Huszagh, S. Rankowitz, and J. Scott 1976 14 p refs Presented at Ocean 76 Symp., Washington, D. C., 13 Sep. 1976
(Contract AT(30-1)-16)
(BNL-20882; Conf-760908-1) Avail: NTIS HC A02/MF A01

A system designed for the measurement of low-frequency phenomena at numerous physically remote and unattended stations is described. It consists of a mobile central command station, a telemetry subsystem operating two dedicated VHF channels, and a set of remote stations. All manual interactions are accomplished at an on-shore central station through a general purpose computer which also controls automatic measuring sequences. ERA

N77-20732# Royal Netherlands Meteorological Inst., De Bilt.
OCEANOGRAPHIC CIRCUMSTANCES IN THE NORTH SEA NEAR THE ISLAND OF TEXEL
M. P. Visser 1977 52 p refs In DUTCH; ENGLISH summary
(KNMI-WR-77-1) Avail: NTIS HC A04/MF A01

The so-called Texel section of the North Sea was sampled over forty times from 1964 to 1969. Situations with no density gradients at all, or with gradients only in horizontal or vertical direction, are shown. The mean situation is shown schematically. Vertical stratification was found to be dependent on tidal phase to a minor degree only; however, a strong connection was found between the existence or absence of vertical density stratification in the water, and the occurrence of strong winds. The latter can almost prevent such a stratification near Texel for a period of 25 to 42 days after its event. These figures agree well with the average time fresh water takes between its leaving the Rhine estuary and its arrival near Texel. Author (ESA)

N77-20733# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
BAROTROPIC TESTING OF THE REGIONAL OPEN OCEAN MODEL
Joel E. Hirsh Jun. 1976 27 p refs
(Grant NSF IDO-71-04213)
(PB-259294/7; NSF/IDOE-76-177) Avail: NTIS HC A03/MF A01 CSCL 08C

Barotropic testing of two independent versions of a regional open ocean model is described. These tests were designed to check the correctness of the computer code and to ascertain the behavior of numerical solutions when compared with known

analytical solutions. Results indicate that both versions are correct and accurate to second order in space and time. As expected for an inviscid nonlinear model, vorticity tended to cascade into the smallest resolved scale. In addition, normal modes of the box (homogeneous solutions) tended to be excited by truncation error; however, these modes decayed rapidly as the resolution was increased. GRA

N77-20734# National Data Buoy Center, Bay Saint Louis, Miss.
PROCEEDINGS OF THE OCEAN PROFILING WORKSHOP
Jun. 1976 192 p refs Workshop held at Bay St. Louis, Miss., 2-4 Jun. 1976
(Grant NSF OCE-76-12177)
(PB-259296/2; NSF/IDOE-76-176) Avail: NTIS HC A09/MF A01 CSCL 08J

Major objectives of the workshop were to identify and categorize the various uses and applications for subsurface water temperature and salinity data, primarily in the upper layers of the oceans; define the near-term and long-range data measurement requirements and characteristics for these applications and the sensitivity of the user's application to the required data; and establish any commonalities that may exist between these various data measurement requirements. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-20735# Advisory Group for Aerospace Research and Development, Paris (France).
SPECIAL ASPECTS OF AVIATION OCCUPATIONAL AND ENVIRONMENTAL MEDICINE
M. S. Hughes, ed. (RAF Inst. of Aviation Medicine, Farnborough, England) Feb. 1977 88 p refs In ENGLISH; partly in FRENCH Conf. Proc. of the Aerospace Medical Panel Specialists, Meeting, Athens, 20-24 Sep. 1976
(AGARD-CP-202; ISBN-92-835-0188-8) Avail: NTIS HC A05/MF A01

The medical, psychiatric, and psychological problems of air traffic controllers and radar operators are discussed. The monitoring, measurement, and assessment of potential hazards associated with aircraft operations are explored. Methods for controlling industrial hazards connected with aircraft and missile operations are given. For individual titles, see N77-20736 through N77-20747.

N77-20736# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
PSYCHOLOGICAL PROBLEMS OF AIR TRAFFIC CONTROLLERS AND RADAR OPERATORS **c53**
V. David Hopkin *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 7 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

Secondary radar, advances in display technology and flexibility in workspace design provide solutions to some of the psychological problems associated with air traffic controllers and radar operators. The effects of stress on efficiency and well being are discussed, as well as the problem of boredom. When automation in the form of computer assistance is applied to decision making and problem solving, its implications extend beyond system performance and efficiency to influence job satisfaction, professional pride, opportunities to acquire and use skills, and the integration of the roles of man and machine. These less manifest effects of automation are the source of numerous psychological problems for air traffic controller and radar operators. Author

N77-20737# Eurocontrol Agency, Brussels (Belgium).
STATISTICAL ANALYSIS OF THE PATHOLOGY OF AIR TRAFFIC CONTROL-RADAR OPERATORS: THEIR RELATIONSHIP TO WORK RELATED STRESS **c52**
E. Evrard *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 12 p refs In FRENCH (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

Causes of death in 693 radar/controllers from the Belgian air force using nonautomated equipment, and 149 civil operators using only automated systems were studied to determine if the psychological and physiological responses associated with their work result in a particular pathology, with significant frequency. The study shows an almost total absence of visual or auditory pathology in those using automated equipment. Pathology associated with nervous tension is more difficult to interpret. A comparison of the pathologies in controllers, assistance controllers, students, technicians, and administrative personnel reveal no evidence of a pathology peculiar to controller/radar operators. Author

N77-20738# Italian Air Force Medical Appeal Board, Rome.
PSYCHOPATHOLOGY OF AIR TRAFFIC CONTROLLERS AND RADAR OPERATORS **c53**
Luigi Longo *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 5 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

The activities of air traffic controllers and radar operators have, within the aeronautical sphere, particular connotations because of the environment in which they are carried out and because of their technical and operational content. These connotations are such that they may give rise to a stress effect with consequent psychic pathology of variable intensity. On the basis of observations and personal experience, a general nosgraphic description of the syndromes and of the psychopathologic states most frequently noted, is submitted and considerations and proposals are formulated with the aim of preventing and containing them. Author

N77-20739# School of Aerospace Medicine, Brooks AFB, Tex. Radiobiology Div.
USAF EXPOSURE STANDARDS FOR RADIOFREQUENCY/MICROWAVE HAZARDS CONTROL **c52**
John C. Mitchell *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 7 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

The effects of radiofrequency radiation on the nervous system, behavior, and the eye, and such indirect biological effects as cardiac pacemaker interference are discussed in terms of their impact on setting appropriate personnel exposure criteria for operational RF emitters. Of primary importance is the recognition that radiofrequency (10 kHz - 300 GHz) radiation insult to man is strongly frequency dependent. Thus, all bioeffects data generated in the laboratory using smaller animals must be carefully scaled/extrapolated to equivalent effects on man before meaningful exposure standards can be established. This frequency dependent concept is reflected in United States Air Force Regulation 161-42, which establishes a 50 mW/sq cm permissible exposure limit (PEL) for radiofrequencies from 10 kHz to 10 MHz and retains the previously established 10 mW/sq cm PEL for radiofrequencies from 10 MHz to 300 GHz. Author

N77-20740# Letterman Army Inst. of Research, San Francisco, Calif. Non-Ionizing Radiation Div.
BIOEFFECTS RESEARCH IN THE DETERMINATION OF LASER HAZARDS **c52**
Edwin S. Beatrice, Harry Zwick, and David J. Lund *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 5 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

A summary of the endpoints used in the establishment of ocular damage threshold levels from laser exposure includes the evaluation of grossly visible retinal opacity photoreceptor alteration at the level of the light and electron microscope and functional alteration in the task oriented animal subject. The threshold determination at the light and ultrastructural levels extends the sensitivity and reduces the threshold level for all laser wavelengths. The behavioral evaluation of laser exposures are one thousand times below the visible lesion endpoint and demonstrates changes which must be taken into account in the evaluation of permissible human levels. A review of the research in the area of retinal effects from laser radiation will provide, at low levels, a comprehensive review of the function of the retina and central

nervous system interconnections as applied to normal ambient light level exposures. Author

N77-20741# Army Aeromedical Research Lab., Fort Rucker, Ala. Bioacoustics Div.

THE ATTENUATION EFFICIENCY SCORE: A MEASURE OF OVERALL HEARING PROTECTIVE EFFICIENCY OF HEARING PROTECTORS **c54**

Robert T. Camp, Jr. *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 7 p refs (For primary document see N77-20735 11-51)

Avail: NTIS HC A05/MF A01

A method is given for obtaining an overall description of sound attenuation characteristics of hearing protectors with a single value. The derivation of the attenuation efficiency score (AES) is presented with emphasis on the reasons why it is an unbiased estimate and is compared with other methods that express overall attenuation in a single decibel value. The normalization of low and high frequency attenuation values into percentiles eliminates high frequency biasing of overall evaluations that occur with averaged decibel values. Author

N77-20742# Ministry of Defence, London (England). Directorate of Civilian Medical Services.

NOISE LEVELS AND THEIR MEASUREMENTS AND INTERPRETATION IN THE VICINITY OF MILITARY AIRFIELDS **c71**

S. Kanagasabay *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 6 p refs (For primary document see N77-20735 11-51)

Avail: NTIS HC A05/MF A01

Indexes for nuisance noise from road traffic, aircraft, and industrial premises were formulated and related to the civilian environment. The noise source from aircraft and in particular, the noise in the vicinity of airfields was studied. In view of already existing legislation providing recompense for the population affected by noise levels in excess of criteria laid down for civil airfields. The Royal Air Force was required to develop criteria for noise in the vicinity of military airfields. Author

N77-20743# Office of the Surgeon General (Air Force), Washington, D.C.

US AIR FORCE ENVIRONMENTAL AND OCCUPATIONAL HEALTH PROGRAM **c52**

Johan E. Bayer *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 5 p (For primary document see N77-20735 11-51)

Avail: NTIS HC A05/MF A01

The greater awareness of the inter-relationship between man and his environs caused the Air Force and its surrounding communities to integrate efforts to cope with the problems of air and water pollution, noise, control, national environmental policy act, and occupational safety and health. Also of concern are specific industrial and environmental health problems associated with aircraft servicing and maintenance, fuel spillage, wash rack effluent, industrial wastes, drinking water, and electromagnetic energy. The numerous laws and the impact on the daily activities of the Air Force are discussed. The manpower and organizational structures the Air Force created and proposes to create in response to new legislation and policies are described. Author

N77-20744# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Toxic Hazards Div.

OCCUPATIONAL HAZARDS OF MISSILE OPERATIONS WITH SPECIAL REGARD TO THE HYDRAZINE PROPELLANTS **c52**

Kenneth C. Back, Vernon L. Carter, Jr., and Anthony A. Thomas *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 10 p refs (For primary document see N77-20735 11-51)

Avail: NTIS HC A05/MF A01

Hydrazine (HZ), monomethylhydrazine (MMH), and 1,1-dimethylhydrazine (UDMH) are quite toxic and present a potential hazard for personnel who handle or are in contact with them under any and all conditions. In addition, they pose a hazard to the general population if accidentally released into the environment as a result of missile malfunction or transportation mishap. Experimental studies indicate that the convulsive action of MMH and UDMH can be aborted by the use of vitamin B6, though the agent is ineffective against hydrazine. Evidence from animal experiments indicates that HZ, MMH, and UDMH may possess oncogenic potential as well as chronic systemic effects. Threshold limit value, emergency tolerance criteria for short-term exposure to the public, and oncogenic potential of these hydrazines are explored. Author

N77-20745# British Airways Medical Service, Middlesex (England).

THE USE AND CONTROL OF HAZARDOUS MATERIALS IN AIRCRAFT MAINTENANCE **c01**

D. M. Bruton *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 3 p (For primary document see N77-20735 11-51)

Avail: NTIS HC A05/MF A01

The principles of toxic materials control involve the use of the least hazardous material compatible with technical requirements, containment, local exhaust ventilation and the avoidance of direct handling. In addition, there is need for good general standards of ventilation and housekeeping, safe methods of work, and the use, where necessary, of protective clothing and equipment. Materials control procedures require a system of communication enabling materials to be identified, their hazards evaluated and brought to the attention of management and employees, and the necessary safeguards established, communicated, and implemented. Two measures developed in British Airways as part of the control and communication process are described. Author

N77-20746# Ministry of Defence, London (England).

OCCUPATIONAL HEALTH HAZARDS ASSOCIATED WITH AIRCRAFT SHELTER OPERATIONS **c52**

S. Kanagasabay *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 8 p refs (For primary document see N77-20735 11-51)

Avail: NTIS HC A05/MF A01,

The design features of shelters, which are intended to give a reasonable probability of survival of the aircraft and maintain an operational capability, are those which also fulfil the criteria for a confined space. The occupational health hazards to personnel employed in shelter operations therefore are essentially those associated with aircraft operations qualified by the restrictions applicable to a limited work-space. Potential hazards are identified as those arising from the turbine and petrol engines of ground support equipment necessary for front line maintenance. These are noise, fuel vapor and exhaust pollutants. Environmental levels of the pollutants under typical operations are compared with current threshold limit values. Recommendations are made for: (1) reduction of exposure; (2) permissible excursions above current threshold limit values for specific pollutants; and (3) biological monitoring of exposed personnel. Author

N77-20747# Institutes fuer Wehrmedizin und Hygiene, Koblenz (West Germany). Defense Physiology Div.

CO DOSE METER FOR WORKING PLACES EXPOSED TO EXTREME PEAKS OF CO-CONTAMINATION **c35**

G. Kleinhanss and C. Piekarski *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 5 p refs (For primary document see N77-20735 11-51)

Avail: NTIS HC A05/MF A01

For certain marginal conditions the product of carbon monoxide concentration (c) times the time of exposure (t) determines the amount of CO load which affects subjects working in several industries and military facilities. The determination of c times t is easy whenever c remains constant. If c varies, the following methods can be used: continuous integration of c over the elapsed time (Im), or collection of aliquot quantities of gas samples during exposition and following multiplication of the mean concentration of c with the time lapsed t (SM). Advantages and disadvantages of both methods are discussed. As a consequence, a modified sampling method is introduced (MSM) which combines essential advantages of LM and SM especially accuracy, reliability in field tests, and validity. Author

N77-20748*# Transemantics, Inc., Washington, D.C.
PLANTS IN THE GRAVITATIONAL WORLD
Yu. Kolesnikov NASA Mar. 1977 11 p Transl. into ENGLISH from Nauka i Zhizn (USSR), no. 12, 1976 p 76-79
(Contract NASw-2792)
(NASA-TT-F-17528) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments of the past and present dealing with the effect of gravity and weightlessness on plants and its possible stipulated. Author

N77-20749# Oregon State Univ., Corvallis. Water Resources Research Inst.
PLANT PRODUCTION IN EXPERIMENTAL STREAMS. A COOPERATIVE RESEARCH PROJECT WITH WEYERHAEUSER COMPANY Completion Report
David E. Busch and C. David McIntire Sep. 1976 22 p refs Prepared in cooperation with Weyerhaeuser Co.
(OWRT Proj. A-035-ORE(1))
(PB-259606/2; WRRI-45; W77-00735) Avail: NTIS HC A02/MF A01 CSCL 13B

The general objective was to determine the effects of nutrient enrichment and other environmental changes on rates of primary production and on the structure of algal communities in experimental streams. Nutrient enrichment, primarily nitrogen, can simulate introductions related to forest management policies practiced by Weyerhaeuser Company, Longview, Washington, namely forest fertilization and nutrient introductions resulting from logging activities. The project was designed as a sequence of two experiments, designated the winter and summer experiments. The winter experiment involved reducing light intensity, while the summer experiment was concerned with nutrient (nitrate) enrichment at different light intensities. GRA

N77-20750# Virginia Univ., Charlottesville. Dept. of Chemical Engineering.
ENZYME TECHNICAL AND RENEWABLE RESOURCES
John L. Gainer 1976 119 p refs Conf. held at Charlottesville, Va., 19-21 May 1976
(Grant NSF AER-76-10365)
(PB-259615/3; NSF/RA-760180) Avail: NTIS HC A06/MF A01 CSCL 06A

The conference was designed to emphasize areas dealing with renewable resources such as nitrogen fixation, biophotolysis, biomass utilization, food systems-proteins, and food systems-carbohydrates. Summaries of the talks, presentations concerning previous workshops, and a list of conference attendees are included. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-20751*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 165, MARCH 1977
Mar. 1977 70 p
(NASA-SP-7011(165)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 198 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1977. Author

N77-20752# Civil Aeromedical Inst., Oklahoma City, Okla.
PHYSIOLOGICAL BIOCHEMICAL, AND MULTIPLE-TASK-PERFORMANCE RESPONSES TO DIFFERENT ALTERATIONS OF THE WAKE-SLEEP CYCLE
E. A. Higgins, W. D. Chiles, J. M. McKenzie, G. E. Funkhouser, M. J. Burr, A. E. Jennings, and J. A. Vaughan Nov. 1976 23 p refs
(AD-A033889/7; FAA-AM-76-11) Avail: NTIS HC A02/MF A01 CSCL 06/19

Three groups, each comprising five healthy, male, paid volunteers, were studied for 11 days. Baseline data were collected for 3 days, during which subjects adhered to a day/night routine. According to the physiological and biochemical measurements, there was little difference between the two 6-hour-change groups, both of which required longer rephasal times than did the group that experienced sleep loss but no time change. The psychomotor performance test indicated the greatest change in the group whose day was shortened by 6 hours. Author

N77-20753# Civil Aeromedical Inst., Oklahoma City, Okla.
SOME EFFECTS OF SLEEP DEPRIVATION ON TRACKING PERFORMANCE IN STATIC AND DYNAMIC ENVIRONMENTS
Williams E. Collins Oct. 1976 10 p refs
(AD-A033331/0; FAA-AM-76-12) Avail: NTIS HC A02/MF A01 CSCL 06/19

The influence of approximately 34 and 55 hours of sleep deprivation on performance scores derived from manually tracking the localizer needle on an aircraft instrument was assessed under both static and dynamic laboratory conditions. All tests were conducted in an enclosed Stille-Werner rotator in total darkness with the exception of the illuminated tracking display. Significant decrements in dynamic tracking performance were uniformly obtained after 24 hours and more of sleep loss. Static tracking scores were also impaired but less consistently so. The study indicates clear declines in performance scores for an aviation-related task after a night without sleep. These negative effects become generally greater with increasing amounts of sleep loss and are more pervasive in motion environments. Author

N77-20754# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MECHANICAL RESONANT FREQUENCY OF THE HUMAN EYE IN VIVO Ph.D. Thesis
Morton K. Ohlbaum Aug. 1976 105 p refs
(AF Proj. 7222)
(AD-A030476; AMRL-TR-75-113) Avail: NTIS HC A06/MF A01 CSCL 06/19

A hypothetical mechanism of partial visual tracking to account for the viewing distance dependency of visual performance in vibration was criticized because ocular resonance was not considered. By means of mechanical and photographic techniques, the resonant frequency of the eye was found to be 18 Hz; however, the amplification factor is insufficient to account for the observed performance. Additional psychophysical tests were not inconsistent with original hypothesis, and also demonstrate that the major component of the eye movement is rotational rather than translational. Author (GRA)

N77-20755# Naval Medical Research Inst., Bethesda, Md.
RESPIRATORY HEAT LOSS AND PULMONARY FUNCTION DURING COLD-GAS BREATHING AT HIGH PRESSURES Medical Research Progress Report
B. Hoke, D. L. Jackson, J. M. Alexander, and E. T. Flynn 1976 18 p refs Proc. of Symp. on Underwater Physiol., Bethesda, Md., 1976
(AD-A030315) Avail: NTIS HC A02/MF A01 CSCL 06/19

In deep diving, significant heat loss through the lungs--both in warming and in humidifying the inspired cold gas--occurs due to the increased thermal capacity of the breathing-gas mixture. Other factors which increase respiratory heat loss (RHL) are a decrease in inspired gas temperature (T1) and an increase in respiratory minute volume (VE). The purpose of this study was to measure RHL in two divers at rest and at four graded levels of exercise while breathing cold gas at simulated depths to 1,000 feet of sea water (fsw). A secondary purpose was to study cardiopulmonary function and to investigate the possibility of pulmonary damage from dense, cold gas acting directly on the respiratory tract mucosa. GRA

N77-20756# Naval Medical Research and Development Command, Bethesda, Md.
BIBLIOGRAPHY OF REPORTED BIOLOGICAL PHENOMENA (EFFECTS) AND CLINICAL MANIFESTATIONS ATTRIBUTED TO MICROWAVE AND RADIO-FREQUENCY RADIATION, SUPPLEMENT NO. 8 Interim Report
Zorach R. Glaser and Patricia F. Brown Aug. 1976 27 p refs (MF51524015)
(AD-A029430) Avail: NTIS HC A03/MF A01 CSCL 06/18

Almost 350 additional references on the biological responses to radio frequency and microwave radiation, published up to August 1976, are included in this continuing bibliography of the world literature. Particular attention has been paid to the effects of non-ionizing radiation on man at these frequencies. The citations are arranged alphabetically by author (where possible), and contain as much information as possible so as to assure effective retrieval of the original documents. Soviet and East European literature is included in detail. GRA

N77-20757# Army Inst. of Dental Research, Washington, D.C.
PULP EFFECTS OF NEODYMIUM LASER: A PRELIMINARY REPORT Technical Report, Jan. 1975 - Aug. 1976
James C. Adrian 19 Aug. 1976 13 p refs
(AD-A029676) Avail: NTIS HC A02/MF A01 CSCL 06/18

A total of eight teeth from two Rhesus monkeys were exposed to various amounts of Neodymium laser radiation. The pulp response was found to be much less severe than that in a study of 19 teeth previously reported for exposure to similar amounts of ruby laser radiation. If additional studies support this initial finding, it is suggested that a reevaluation of laser mediated procedures in vital teeth be initiated. GRA

N77-20758# Maryland Univ., College Park. Center of Adult Education.
OCCUPATIONAL EXPOSURE TO FIBROUS GLASS: A SYMPOSIUM
Apr. 1976 396 p refs Conf. proc. held at College Park, Md., 26-27 Jun. 1974 Sponsored by the Natl. Inst. for Occupational Safety and Health
(PB-258869/7; NIOSH-76-151) Avail: NTIS HC A17/MF A01 CSCL 06J

Current research related to fibrous glass exposure is reported. The primary purpose was to fill the previously identified gaps in NIOSH's knowledge of the healt effects of fibrous exposure, including long-term effects of exposure to small diameter fibers and their mechanism of action. Considered are: the technology of fibrous glass; physical and aerodynamic properties; environmental measurements of airborne fibrous glass; biologic effects; and epidemiologic studies. GRA

N77-20759# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ECONOMIC IMPACT ANALYSIS OF PROPOSED NOISE CONTROL REGULATION Final Report
21 Apr. 1976 126 p refs Prepared in cooperation with Abt Associates, Inc., Cambridge, Mass.
(Contract DOL-J-9-F-6-0019)
(PB-258841/6; BBN-3246; OSHA-EIA-76-421) Avail: NTIS HC A07/MF A01 CSCL 06J

Those aspects of the proposed noise regulation are analyzed which are not part of the present OSHA noise regulation (29CFR1910.95). The proposed regulation maintains the 90 dbA levels but adds provisions for audiometric testing and noise monitoring when workers are exposed to noise levels greater than 85 dbA. The proposed regulation (90 dbA) would cost $241 million annually. An 85 dbA regulation achieved solely by use of hearing protection would cost an additional $43 million annually; an 85 dbA regulation achieved through an engineering controls would require an initial investment of $8 billion, but would eliminate the need and annual cost of audiometric testing upon compliance. GRA

N77-20760# Vermont Univ., Burlington. Dept. of Pathology.
EVALUATION OF MATERIALS FOR THEIR THROMBOEMBOLIC AND BLOOD EFFECTS Annual Report, 1 Dec. 1975 - 31 Jul. 1976
Lawrence S. Harris, John E. Craighead, and Rodney Larrow 1 Aug. 1976 68 p refs Sponsored by the National Heart and Lung Inst.
(PB-259118/8; NIH-N01-HV-5-2939-6) Avail: NTIS HC A04/MF A01 CSCL 06L

Refinement and use of an in vivo renal thromboembolus test system for the evaluation of promising and well characterized new biomaterials are reported. The renal embolus test system involves the use of the canine renal vascular bed and parenchyma as a sensitive biologic indicator system of thromboembolic sequellae. A number of promising synthetic materials was evaluated. Severity of implant thrombosis and renal infarct patterns are noted and recorded. Topographical mapping of mural and junctional ring thrombotic deposits are schematically demonstrated. GRA

N77-20761# Office of Radiation Programs, Washington, D.C.
RADIATION PROTECTION: 1975. ANNUAL EPA REVIEW OF RADIATION PROTECTION ACTIVITIES
Jun. 1976 185 p refs
(PB-259655/9; EPA-520/7-76-004) Avail: NTIS HC A09/MF A01 CSCL 06R

Nuclear energy, medical, occupational and consumer product radiation, and naturally-occurring radioactivity are characterized. Other nuclear energy activities, nonionizing radiation, and international activities of interest to the U. S. are also concurred. GRA

N77-20762# Andros, Inc., Berkeley, Calif.
FAST RESPONSE CO/SF6 PULMONARY FUNCTION ANALYZER FOR CONTINUOUS DIFFUSION CAPACITY MEASUREMENT Annual Report, Jun. 1974 - Jul. 1975
P. M. Portner, D. H. LaForge, and J. A. Nadel Jul. 1975 61 p refs
(Contract HR-3-3002)
(PB-258867/1; ARFR-91; NIH-N01-HR-33002-A75) Avail: NTIS HC A04/MF A01 CSCL 06B

The pulmonary diffusion capacity analyzer which is the subject of this report operates on a non-dispersive infrared principle and provides-from a single breath of sample gas-a continuous profile of absorption. Carbon monoxide is the sample, and sulphur hexafluoride is the inert dilution reference. The two gases are continuously measured as the expired breath passes through the single sample cell. In the 1974-1975 period, the prototype analyzer (designed and bread-boarded in the previous year) was completed, and thorough system characterization was carried out. Then, clinical testing was initiated in collaboration with the Cardiovascular Research Institute of the University of California. Preliminary results of this testing and their contribution to further development are presented. GRA

N77-20763# Aerojet Liquid Rocket Co., Sacramento, Calif. Energy Systems.
DEVELOPMENT AND EVALUATION OF A PNEUMATIC LEFT VENTRICLE ASSIST SYSTEM Annual Report, Jul. 1975 - May 1976
S. Andrus May 1976 173 p refs
(Contract HV-3-2930)
(PB-259116/2; TR-9280-430-76; NIH-N01-HV-3-2930-2) Avail: NTIS HC A08/MF A01 CSCL 06L

The wear and fatigue-sensitive components of the engine were evaluated during 33,000 hours of testing. Wear measurements and accelerated life testing of individual components have indicated the 10 year durability potential of the system. Over 7000 hours of system testing was accumulated. In vitro evaluation of the system with the recently available PAC-6 utilizing a flow loop and a 37C air enclosure attained maximum system efficiency of 10.6% corresponding to delivery of 3.5 watts to the blood pump with 33 watt thermal input. The pneumatic control concept achieved flawless synchronization with the mock ventricle over the range from 60 to 140 beats per minute. GRA

N77-20764# Utah Univ., Salt Lake City. Dept. of Bioengineering.
RADIOFREQUENCY RADIATION DOSIMETRY HANDBOOK Interim Report, 1 Jan. - 31 Jul. 1976
C. C. Johnson, C. H. Durney, P. W. Barber, H. Massoudi, Stewart J. Allen, and J. C. Mitchell Sep. 1976 126 p refs
(Contract F41609-76-C-0025; AF Proj. 7757)
(AD-A030874; SAM-TR-76-35) Avail: NTIS HC A03/MF A01 CSCL 06/18

Considerable effort has been expended recently in biological experimentation and theoretical analysis of radiofrequency electromagnetic radiation effects on humans and experimental animals. An important part of this work is dosimetry, determining the amount of energy that is absorbed in the tissues. To provide the link between biological effects observed in irradiated animals and corresponding effects which might occur in man, theoretical methods are necessary to relate absorbed energy in man and

animals to the incident radiation intensity. A handbook of data has been compiled to fill this need. Author (GRA)

N77-20765# Environmental Protection Agency, Washington, D.C. Subcommittee on Technic of Exposure Prevention.
RECOMMENDATIONS ON GUIDANCE FOR TECHNIC TO REDUCE UNNECESSARY EXPOSURE FROM X-RAY STUDIES IN FEDERAL HEALTH CARE FACILITIES
Jun. 1976 43 p refs
(PB-259866/2; EPA-520/4-76-012) Avail: NTIS HC A031/MF A01 CSCL 06E

It is possible to reduce exposure from diagnostic uses of X-rays by: (1) eliminating clinically unproductive examinations, (2) assuring the use of optimal technic when examinations are performed, and (3) requiring appropriate equipment to be used. The use of equipment and technic to perform medical and dental X-ray examinations were examined and recommendations were made for guidance to assure that diagnostic quality radiographs are produced with minimal patient exposure. GRA

N77-20766# Wisconsin Univ., Madison.
EVALUATION OF NON-POLAROGRAPHIC BLOOD GAS SENSORS Annual Report, 15 May 1975 - 1 Jun. 1976
Stuart J. Updike, Thomas A. Massaro, and Jean C. Behrens-Tepper Jul. 1976 42 p refs
(Contract N01-HR-5-2950)
(PB-259766/4; NIH-N01-HR-52950-1A) Avail: NTIS HC A03/MF A01 CSCL 06A

This project is concerned with two systems. One is based on gas chromatographic analysis; the second employs a mass spectrometric analysis to obtain pO2 and pCO2. The goals are to develop and evaluate these two systems and to provide information on the clinical utility of the two techniques. GRA

N77-20767# Nuclear Regulatory Commission, Washington, D.C. Div. of Engineering Standards.
MEASUREMENT OF RADIATION EXPOSURE RECEIVED BY FLIGHT ATTENDANTS FROM SHIPMENTS OF RADIOACTIVE MATERIAL
Anthony N. Tse Nov. 1976 46 p refs
(PB-259940/5; NR/DES-0001) Avail: NTIS HC A03/MF A01 CSCL 06R

A study was conducted in late 1974 to measure physically the radiation dose received by selected flight attendants from shipments of radioactive material transported on board commercial airline flights in the United States. This study was sponsored jointly by the two flight attendant's unions and by the U.S. Nuclear Regulatory Commission. Analyses of the data indicate that the radiation dose received by most flight attendants from these shipments is small and is well below the limit recommended for individuals of the general public by international and national organizations on radiation protection. GRA

N77-20768# Harvard Univ., Cambridge, Mass.
EXPOSURE OF AIRPORT WORKERS TO RADIATION FROM SHIPMENTS OF RADIOACTIVE MATERIALS. A REVIEW OF STUDIES CONDUCTED AT SIX MAJOR AIRPORTS
Jacob Shapiro, H. Cember (Northwestern Univ.), P. M. Lorio (Columbia Univ., New York), K. Luszczynski (Wash. Univ., St. Louis), C. A. Sondhaus (Calif. Univ., Irvine), and R. Wallace (Calif. Univ., Berkeley) Feb. 1976 32 p refs
(Contract NUREG-DR-75-1505)
(PB-259784/7; NR/DES-0002) Avail: NTIS HC A03/MF A01 CSCL 06R

Descriptions were obtained of the handling and arrangment of the packages; dose distributions were mapped around groupings of packages, and doses received by workers were evaluated both on the basis of time-motion studies and through readings of personal monitoring devices. Results of dosimeters worn over extended periods indicated that no workers were expected to receive exposures in excess of 500 millirems per year and most were expected to receive less than 100 millirems per year. GRA

N77-20769# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
SPECTRAL IRRADIANCE OF SEVERAL ULTRAVIOLET SOURCES, JULY - SEPTEMBER 1976
James K. Franks 13 Oct. 1976 13 p
(AD-A031276; USAEHA-42-0305-77) Avail: NTIS HC A02/MF A01 CSCL 06/18

A special study of the optical hazards associated with the operation of five different types of laboratory ultraviolet sources in the Toxicology Division of the U.S. Army Environmental Hygiene Agency was performed. Author (GRA)

N77-20770# Optical Sciences Group, San Rafael, Calif. Visual Sciences Div.
INFLUENCE OF SOCIALLY USED DRUGS ON VISION AND VISION PERFORMANCE Final Report, 1975 - 1976
Anthony J. Adams, Brian Brown, Merton C. Flom, Arthur Jampolsky, and Reese T. Jones 1 Apr. 1976 116 p refs
(Contract DADA17-73-C-3106)
(AD-A030587; Rept-761) Avail: NTIS HC A06/MF A01 CSCL 06/15

Four experiments on single and mixed drug effects on vision function are reported here. The experiments were conducted double blind with placebo controls. The results, in general, do not support an additive model of action of alcohol and marijuana on vision function or other drug affected physiological and psychological variables. Dynamic visual acuity (DVA) is reduced for high and low contrast targets by alcohol and marijuana, and by drugs in combination. The proportion of red and green which must be mixed to match a standard yellow is significantly altered by alcohol, marijuana, and these drugs taken together. Alcohol significantly increases foveal glare recovery time, and marijuana also retards this recovery time. Visual search times are significantly reduced by alcohol and by alcohol and marijuana when taken together. GRA

N77-20771# Virginia Commonwealth Univ., Richmond.
CIRCULATORY EFFECTS OF ACUTE AND CHRONIC HYPOXIA Final Report, 8 Jan. 1973 - 31 Oct. 1975
David W. Richardson and Hermes A. Kontos 7 Apr. 1976 37 p
(Contract DAMD17-74-C-4021)
(AD-A030578) Avail: NTIS HC A03/MF A01 CSCL 06/19

The aim of this work was to clarify the important mechanisms of physiological regulation of the cerebral microcirculation. The important findings of the work were as follows: Effective neurogenic control and responsiveness to norepinephrine was limited to pial arteries larger than 100 microns in diameter. All vessels irrespective of size dilated markedly in response to severe elevations in arterial blood pressure exceeding 200 mmHg. This dilation at very high pressures was frequently irreversible. The vasodilation induced by arterial hypoxia was reversible by increased local supply of oxygen via perfusion of the space under the cranial window with fluorocarbon containing high concentration of oxygen, showing that the vasodilation in response to hypoxia was a local phenomenon. The changes in responsiveness due to long-term adjustments to hypercapnia and hypoxia were the result of increases in CSF bicarbonate ion concentration with hypercapnia and decreases in bicarbonate ion concentration with hypoxia. GRA

N77-20737# Eurocontrol Agency, Brussels (Belgium).
STATISTICAL ANALYSIS OF THE PATHOLOGY OF AIR TRAFFIC CONTROL-RADAR OPERATORS: THEIR RELATIONSHIP TO WORK RELATED STRESS
E. Evrard *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 12 p refs In FRENCH
(For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

N77-20739# School of Aerospace Medicine, Brooks AFB, Tex. Radiobiology Div.
USAF EXPOSURE STANDARDS FOR RADIOFREQUENCY/MICROWAVE HAZARDS CONTROL
John C. Mitchell *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 7 p refs
(For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

N77-20740# Letterman Army Inst. of Research, San Francisco, Calif. Non-Ionizing Radiation Div.
BIOEFFECTS RESEARCH IN THE DETERMINATION OF LASER HAZARDS

Edwin S. Beatrice, Harry Zwick, and David J. Lund *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 5 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

N77-20743# Office of the Surgeon General (Air Force), Washington, D.C.
US AIR FORCE ENVIRONMENTAL AND OCCUPATIONAL HEALTH PROGRAM
Johan E. Bayer *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 5 p (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

N77-20744# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio. Toxic Hazards Div.
OCCUPATIONAL HAZARDS OF MISSILE OPERATIONS WITH SPECIAL REGARD TO THE HYDRAZINE PROPELLANTS
Kenneth C. Back, Vernon L. Carter, Jr., and Anthony A. Thomas *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 10 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

N77-20746# Ministry of Defence, London (England).
OCCUPATIONAL HEALTH HAZARDS ASSOCIATED WITH AIRCRAFT SHELTER OPERATIONS
S. Kanagasabay *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 8 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-20772# Florida Univ., Gainesville. Dept. of Psychology.
STYLE OF GROUP INTERACTION, ANONYMITY, AND GROUP PERFORMANCE AS DETERMINANTS OF EGOCENTRIC PERCEPTIONS
Barry R. Schlenker, and Rowland S. Miller 15 Sep. 1976 56 p refs
(Contract N00014-75-C-0901; NR Proj. 170-797)
(AD-A030498; TR-76-4) Avail: NTIS HC A04/MF A01 CSCL 05/10

Members of cooperative groups usually claim greater personal responsibility for their group's performance after a group success than after a group failure, an attributional bias termed egocentrism. The present study attempted to replicate this basic effect and also to test the following hypotheses: (a) egocentrism would be greater when subjects privately record their perceptions than when they expect to share those perceptions with other group members, and (b) face-to-face interaction among group members during the problem/solving phase of the group's activities would increase group identification and decrease egocentrism as compared to non-face-to-face interaction. GRA

N77-20736# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
PSYCHOLOGICAL PROBLEMS OF AIR TRAFFIC CONTROLLERS AND RADAR OPERATORS
V. David Hopkin *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 7 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

N77-20738# Italian Air Force Medical Appeal Board, Rome.
PSYCHOPATHOLOGY OF AIR TRAFFIC CONTROLLERS AND RADAR OPERATORS
Luigi Longo *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 5 p refs (For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-20773*# Perceptronics, Inc., Woodland Hills, Calif.
STUDY AND DEVELOPMENT OF TECHNIQUES FOR AUTOMATIC CONTROL OF REMOTE MANIPULATORS Final Technical Report
Efraim Shaket and Antonio Leal Aug. 1976 67 p refs Prepared for JPL
(Contract NAS7-100; JPL-954380)
(NASA-CR-152617; PFTR-1027-76-8) Avail: NTIS HC A04/MF A01 CSCL 05H

An overall conceptual design for an autonomous control system of remote manipulators which utilizes feedback was constructed. The system consists of a description of the high-level capabilities of a model from which design algorithms are constructed. The autonomous capability is achieved through automatic planning and locally controlled execution of the plans. The operator gives his commands in high level task-oriented terms. The system transforms these commands into a plan. It uses built-in procedural knowledge of the problem domain and an internal model of the current state of the world. Author

N77-20774*# Old Dominion Univ. Research Foundation, Norfolk, Va. Performance Assessment Lab.
RIDE QUALITY JUDGEMENTS AS A FUNCTION OF ENVIRONMENTAL, PERSONALITY, AND RIDE SPECTRA CORRELATES Final Report
Glynn D. Coates Mar. 1977 29 p refs
(Grant NsG-1225)
(NASA-CR-152626; PAL-PR-77-10) Avail: NTIS HC A03/MF A01 CSCL 05E

Personality and demographic correlates, as well as physical correlates, of ride-quality judgements in a field situation namely, in selected passenger-train ride segments, were identified and investigated. Author

N77-20775*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
HUMAN FACTORS IN DESIGN OF PASSENGER SEATS FOR COMMERCIAL AIRCRAFT: A REVIEW
Stephen F. Schaedel, Ira D. Jacobson, and A. R. Kuhlthau Mar. 1977 36 p refs
(Grant NGR-47-005-181)
(NASA-CR-152627) Avail: NTIS HC A03/MF A01 CSCL 05E

Seat comfort and safety research since the early part of the century is reviewed. The approach blends empirical and theoretical human factors and technical knowledge of seated humans under static and dynamic conditions experienced on commercial aircraft. Author

N77-20776# National Bureau of Standards, Washington, D.C. Center for Fire Research.
DEVELOPMENT OF A PROPOSED FLAMMABILITY STANDARD FOR COMMERCIAL TRANSPORT FLIGHT ATTENDANT UNIFORMS Final Report, Sep. 1974 - Sep. 1976
E. Braun, V. B. Cobble, J. F. Krasny, and R. Peacock Aug. 1976 195 p refs
(Contract DOT-FA75WAI-502)
(AD-A033740/2; FAA-RD-75-176) Avail: NTIS HC A09/MF A01 CSCL 06/17

Currently used uniforms were found to burn to varying degrees when exposed to a temporary small ignition source. The feasibility of designing uniforms with improved fire safety is demonstrated. Trade-offs in terms of cost, appearance, serviceability, and comfort are discussed. A proposed flammability standard for flight attendant uniforms is included. The tests and qualifying criteria

needed to add self-extinguishing characteristics and heat flux resistance to various types of F/A uniform items are described. Author

N77-20777# Battelle Pacific Northwest Labs., Richland, Wash.
PERSONNEL PROTECTION ASPECTS OF X-RAY DIFFRACTION APPARATUS
D. A. Waite, T. W. McClelland, and P. E. Bramson 15 Apr. 1976 13 p Presented at Am. Ind. Hyg. Conf., Atlanta, 16 May 1976
(Contract E(45-1)-1830)
(BNWL-SA-5644; Conf-760525-2) Avail: NTIS HC A02/MF A01

Considerations in radiation safety in using X-ray diffraction equipment are outlined. Important considerations in keeping exposures to a practicable minimum may be categorized into several general groups including: equipment and facility configurations; equipment operational characteristics; radiological evaluation; and operator training. ERA

N77-20778# National Bureau of Standards, Washington, D.C. Product Safety Engineering Section.
CONSIDERATIONS IN DEVELOPING TEST METHODS FOR PROTECTIVE HEADGEAR Interim Report
Robert E. Berger Aug. 1976 54 p refs
(PB-258322/7; NBSIR-76-1107) Avail: NTIS HC A04/MF A01 CSCL 06Q

Among the indications suggested by the model are: (1) the occurrence of reversals in the order of helmet performance when the maximum acceleration is used as a performance measure, (2) the absence of reversals when biomechanical measures are used; and (3) the indicated suitability of compensating for the resiliency of the headform by the resiliency of the impact surface. GRA

N77-20779# Instrument Flight Center, Randolph AFB, Tex.
DETERMINING THE UTILITY OF EXPANDED PITCH SCALE AND FLIGHTPATH ANGLE AS DISPLAY PARAMETERS Final Report
James F. Barnette and Gabriel P. Intano Oct. 1976 37 p
(AD-A031990; IFC-TR-76-4) Avail: NTIS HC A03/MF A01 CSCL 01/4

The Research and Development Division of the USAF Instrument Flight Center (USAFIFC/RD) conducted a pilot factors evaluation to determine the utility of expanded pitch scale and flightpath angle (FPA) as display parameters. Ten subject pilots from the Instrument Flight Center participated in this evaluation. Each subject pilot flew three sorties of approximately 1.3 hours duration in the RD NT-38 aircraft. Based on the responses of the subject pilots and observations of the project pilot, the Instrument Flight Center recommends expanded pitch be displayed on the ADI and FPA be displayed on the right side of the ADI. If a Head-Up Display (HUD) is available, then FPA should be displayed on the HUD. A further study should be conducted to determine the use of flightpath angle and expanded pitch in the high dynamic flight environment. Author (GRA)

N77-20780# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
AIRCREW PROTECTIVE CLOTHING AND DEVICES SYSTEM (FIGHTER/ATTACK AIRCRAFT) Phase Report
Stan J. Winsko and Alan S. Hellman 31 Dec. 1975 49 p
(AD-A031566; NADC-75294-40) Avail: NTIS HC A03/MF A01 CSCL 15/5

A study was conducted to portray the major mission profiles in which the Fighter/Attack community is engaged and by so doing, to identify the problem areas associated with the current inventory of Fighter/Attack Aircrew Protective Equipment toward fulfilling the requirements of these missions. The ultimate objective of this effort is to provide a sound basis from which a series of separate but coordinated engineering developments will be conducted to provide a new generation of mission-oriented protective systems for the Fighter/Attack community. The net effect of this program will be to enhance the inflight performance and effectiveness of all Fighter/Attack aircrewmen with little or no sacrifice to their safety in the event of an emergency situation. Author (GRA)

N77-20781# Human Engineering Labs., Aberdeen Proving Ground, Md.
A COMPARISON OF RED AND WHITE COCKPIT LIGHTING UNDER QUASI-OPERATIONAL CONDITIONS
Neil A. Johnson and Alan M. Poston Jan. 1976 34 p
(AD-A031277; HEL-TM-6-76) Avail: NTIS HC A03/MF A01 CSCL 13/1

In an effort to compare data from basic research on the color of cockpit lighting to an applied environment, an experiment was conducted in a quasi-operational environment. Two OH-58 helicopters were configured with red and white lighting systems respectively, each with individually rheostatically controlled wedge-lighted instruments so that the instrument panel could be balanced for equal brightness between instruments. Five experiments were conducted on legibility, visual acuity, detectability of scale model military targets, peripheral visual performance, and external visual acuity for Landolt rings and full scale military targets in a real-world situation. GRA

N77-20782# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
MODELING THE EFFECTS OF ENVIRONMENTAL FACTORS ON HUMAN CONTROL AND INFORMATION PROCESSING
William H. Levison, Sheldon Baron, and Andrew M. Junker Wright-Patterson, AFB, Ohio AMRL Aug. 1976 121 p refs
(Contract F44620-75-C-0060; AF Proj. 2312)
(AD-A030585; AMRL-TR-76-74) Avail: NTIS HC A06/MF A01 CSCL 05/8

The optimal control model for pilot/vehicle systems has been modified to allow a different treatment of motor related sources of pilot randomness. Specifically, the concept of 'pseudo motor noise' has been implemented to provide a model parameter related more directly to uncertainties about the pilot's control input; this noise is treated as a disturbance on control rate. The revised model is able to provide a good match to low frequency 'phase droop' and to other measures of system performance and pilot response for previously explored tracking tasks. Data obtained in an AMRL experimental study of roll axis tracking are analyzed. The effects of motion cues on tracking performance are modeled by (1) an increment of 0.05 seconds to the pilot time delay, and (2) inclusion of sensory variables that are likely to be provided by motion cues (position, rate, and acceleration of the vehicle roll angle in these experiments). GRA

N77-20783# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Environmental Medicine Div.
PERFORMANCE MEASURES OF HUMAN TRACKING UTILIZING PID MODELING AND A CLOSED LOOP ERROR METRIC
Daniel W. Repperger and Earl J. Hartzell May 1976 9 p refs Presented at IEEE 1976 Natl. Aerospace and Electronics Conf., Dayton, Ohio, 18-20 May 1976
(AF Proj. 7222)
(AD-A031092; AMRL-TR-76-22) Avail: NTIS HC A02/MF A01 CSCL 05/10

Data from an antiaircraft artillery simulator is used to validate the dependence of tracking performance measured by the closed loop error and parameters obtained from a Proportional Integral Derivative (PID) model of the man. A comparison of three tracking teams is used as the data base with an azimuth and elevation operator composing each team. Although this problem is nonstationary, precognitive (a learned tracking task), two axis, and very difficult to model by conventional means, the PID model provides a simple approach to relate the error in the closed loop to the model parameters from each team. In order to provide adequate statistical estimates of these model parameters, identification techniques are applied to the same team (replications) tracking a similar arc tangent flyby trajectory. Statistical analysis was applied to the identified parameters between trackers to evaluate the credibility of this approach. GRA

N77-20784# School of Aerospace Medicine, Brooks AFB, Tex.
BREATHING OXYGEN: PURITY OF OXYGEN GENERATED BY A FLUOMINE-BASED SYSTEM Progress Report, Sep. 1974 - Jun. 1975
L. J. Luskus and H. J. Kilian Sep. 1976 37 p refs
(AF Proj. 7164)
(AD-A030851; SAM-TR-76-25) Avail: NTIS

HC A03/MF A01 CSCL 06/11

Oxygen from a fluomine-based open-loop oxygen-generating system (OLOGS) was analyzed for purity. Major contaminants observed in the product oxygen were H2O, CO2, and CO. The accumulated CO (20-50 ppm) is not considered harmful, nor is CO2 (150-300 ppm) harmful. H2O accumulation was strongly affected by its concentration in supply air and varied between 100 ppm and 5%; oxygen life-support hardware requires its removal. Normal operation of a fluomine-based OLOGS should produce oxygen remarkably free of contamination due to chemical off-gassing. Author (GRA)

N77-20785# Naval Research Lab., Washington, D.C. Chemical Dynamics Branch.

AVIATOR'S BREATHING OXYGEN PURITY Final Report

Ronald S. Sheinson and Frederick W. Williams Jun. 1976 20 p refs

(NRL Proj. C08-05B)

(AD-A030879; NRL-MR-3314) Avail: NTIS HC A02/MF A01 CSCL 06/11

This report reviews the specifications by which Aviator's Liquid Breathing Oxygen (ABO) is judged safe for use. The contaminants which are considered are methane, acetylene, carbon dioxide, 'total hydrocarbons,' halogenated compounds, nitrous oxides, nitrogen oxides, carbon monoxide, ozone, and water. These are discussed in detail, and limits are recommended based on the findings of this report. Author (GRA)

N77-20786# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.

PERFORMANCE EVALUATION OF PROGRAMMABLE ROBOTS AND MANIPULATORS Final Report

Thomas B. Sheridan Oct. 1976 216 p refs Workshop held at Annapolis, Md., 23-25 Oct. 1975

(PB-259631/0; NBS-SP-459; LC-76-600057) Avail: NTIS HC A10/MF A01 CSCL 06D

The workshop concluded that there is a need for: (1) common definitions of many terms which now are the source of pervasive confusion, (2) common test codes, (3) checklists, guidelines, and specifications to help users and suppliers better communicate with one another, and (4) common tests for demonstration and exhibition of new research and development in this field. GRA

N77-20787# Integrated Sciences Corp., Santa Monica, Calif.

ODA PILOT STUDY 2: SELECTION OF AN INTERACTIVE GRAPHICS CONTROL DEVICE FOR CONTINUOUS SUBJECTIVE FUNCTIONS APPLICATIONS

Gary W. Irving, Jennifer J. Horinek, David H. Walsh, and Pak Y. Chan Apr. 1976 43 p

(Contract N00014-75-C-0811)

(AD-A031275; ISC-215-2) Avail: NTIS HC A11/MF A01 CSCL 05/8

This report presents the results of a pilot study undertaken to evaluate the performance of three interactive graphics control devices--light pen, track ball, and joy stick--for the types of 'drawing' tasks required to determine continuous subjective functions (CSF's). This report includes: (1) a brief review of CSF'S in the context of computer-aided decision making; (2) a description of the types of drawing tasks used in generating CSF's; and (3) The experimental design, procedures, performance measures, and interpretation of results. The results of this study conclude that the track ball is the best overall control device for use in subsequent CSF studies. Author (GRA)

N77-20788# Energy Systems Corp., Nashua, N. H.

ARMY LIFE-SUPPORT POWER SOURCE SYSTEM (ALPSS) FOR ENVIRONMENTAL CONTROL OF CASUALITY HOLDING AND EVACUATION BAG Final Report, 1 Nov. 1975 - 31 Aug. 1976

Dinesh K. Gupta Aug. 1976 124 p

(Contract DAMD17-76-C-6029; DA Proj. 3A1-62110-AB-16) (AD-A031214; ESC-6029-1) Avail: NTIS HC A06/MF A01 CSCL 06/11

An improved casualty holding and evacuation bag heating system for hypothermia prevention and treatment was developed. The system is comprised of a liquid loop tubulated linear and a battery-less catalytic power source. The power source burns a fuel (propylene in this case) catalytically to generate heat and electricity. A liquid is heated and recirculated through the liner in the bag. The system is capable of delivering in excess of 250 watts (853 Btu/hr) heat into the bag which is more than adequate to maintain the casualty comfortably warm at -50F (-45.6C). GRA

N77-20789# North American Aviation, Inc., Columbus, Ohio.

TARGET ACQUISITION PERFORMANCE WITH AN AIRBORNE TELEVISION SYSTEM. PART 1: FLIGHT PROFILE, LENS SIZE, AND VISIBILITY

G. W. Levy, G. N. Ornstein, and A. P. Verdi Jun. 1976 82 p (Contract NOw-61-0719)

(AD-A030050; NA-63H-427-Pt-1; NWC-TP-5863-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 17/8

This report describes a simulation study of human target acquisition performance with an airborne television system. The study provides data on success probability and slant range at acquisition as a function of flight profile, camera lens focal length, and visibility. Acquisition factors investigated were: probability of acquiring a prebriefed target area, probability of acquiring a target, and slant range to target at the time of target area acquisition and target acquisition. Also measured was the time required to center the target image on the TV monitor screen following target acquisition. A total of 1,350 simulated flights were run with 15 pilots and engineers as observers. Statistical analyses and normative distributions of the performance measures obtained for different flight profiles, camera lens focal lengths, and visibility conditions are presented and discussed. Author (GRA)

N77-20790# Air Force Human Resources Lab., Brooks AFB, Tex.

DEVELOPMENT AND EVALUATION OF PRETRAINING AS AN ADJUNCT TO A PILOT TRAINING STUDY

Robert W. McFadden, Bernell J. Edwards, and Dolores M. Tyler Jun. 1976 104 p refs

(AD-A031801; AFHRL-TR-76-14) Avail: NTIS HC A06/MF A01 CSCL 05/9

The utility of the pretraining of task-relevant cognitive skills within the context of experimental research methodology was investigated in this study. A criterion-referenced pretraining multi-media product was developed and applied to support the initial phase of an experimental research effort in which several instructional methods for training pilots in an aircraft simulator were investigated. The objectives of the pretraining materials phase of the study were: (1) To provide a standardized, replicable method of orientation of subjects across three experimental groups, (2) To permit the training and assessment of prerequisite entry behaviors which were relevant to the tasks taught in the simulators, and (3) To enhance experimental control for the study. Instructional materials consisted of a modified programmed text, review questions, a video taped briefing/demonstration, and a criterion test. Materials were validated using two sample groups from the target population of undergraduate pilot training (UPT) casual students. The multi-media pretraining package was applied during the initial or orientation phase of the instructional strategies study. Criterion test scores of the experimental groups receiving pretraining exceeded acceptance criteria for the specified prerequisite skills as called for in the instructional product validation. Achievement scores on the criterion test for the experimental groups closely replicated those of the validation group. This study demonstrated the value of cognitive pretraining as an adjunct to experimental research methodology in which subjects required training in prerequisite skills prior to formal data collection activities. GRA

N77-20741# Army Aeromedical Research Lab., Fort Rucker, Ala. Bioacoustics Div.

THE ATTENUATION EFFICIENCY SCORE: A MEASURE OF OVERALL HEARING PROTECTIVE EFFICIENCY OF HEARING PROTECTORS

Robert T. Camp, Jr. *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 7 p refs (For primary document see N77-20735 11-51)

Avail: NTIS HC A05/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N77-20791# Mathematics and Computation Lab., Washington, D. C. Time Sharing Systems Div.

CHECKPOINT INTERFACE ROUTINES FOR FORTRAN 5 UNDER THE UNIVAL 1100 SERIES OPERATING SYSTEM Final Report

Robert C. Peake Oct. 1976 18 p Supersedes GSA/FPA/MCL-TM-236

(PB-258916/6; GSA/FPA/MCL-TM-236-Rev-1; GSA/FPA/MCL-TM-236) Avail: NTIS HC A02/MF A01 CSCL 09B

This package enables a FORTRAN user dynamically to request checkpoints at intervals based upon Central Processor Unit (CPU) time and elapsed time. Some benefits of checkpoints (rerun dumps) are as follows: (1) the user has the capability of recovery in the event of system software or hardware failure; (2) any reel of a multiple reel tape file may be reproduced; (3) long batch runs that are removed from the system may be continued at a suitable time and date. GRA

N77-20792# Naval Postgraduate School, Monterey, Calif.

MINI AND MICRO COMPUTERS IN COMMUNICATIONS M.S. Thesis

Victor Edward Hipkiss and Carl Robert Schramm Sep. 1976 74 p refs

(AD-A031892) Avail: NTIS HC A04/MF A01 CSCL 09/2

Mini and micro computers represent the newest developments in the computer field. Their small size, low cost, and wide ranging versatility make them valuable devices for use in communications systems. They can be used to perform many of the message handling functions previously performed by the main computer, thus freeing it for its more important application tasks. The use of mini and micro computers as front end processors, data concentrators and terminal controllers is investigated, as well as general hardware and software features such small computers must have to perform communications functions. A cost comparison between minicomputers, microcomputers and hardwired devices is also presented. GRA

N77-20793# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

ARITHMETIC SHIFTING CONSIDERED HARMFUL

Guy L. Steele, Jr. Sep. 1976 15 p refs

(Contract N00014-75-C-0643)

(AD-A031883; AI-M-378) Avail: NTIS HC A02/MF A01 CSCL 09/2

For more than a decade there has been great confusion over the semantics of the standard 'arithmetic right shift' instruction. This confusion particularly afflicts authors of computer reference handbooks and of optimizing compilers. The fact that shifting is not always equivalent to division has been rediscovered over and over again over the years, but has never been publicized. This paper quotes a large number of sources to prove the widespread extent of this confusion, and then proceeds to a short discussion of the problem itself and what to do about it. GRA

N77-20794# Naval Postgraduate School, Monterey, Calif.

A MICROPROCESSOR-CONTROLLED DATA ACQUISITION SYSTEM FOR THE FEDERAL SCIENTIFIC MODEL UA-500-1 UBIQUITOUS SPECTRUM ANALYZER M.S. Thesis

Thomas Frederick Sauntry Sep. 1976 75 p refs

(AD-A031869) Avail: NTIS HC A04/MF A01 CSCL 09/2

A microprocessor-controlled data acquisition system is described. The data acquisition system was developed to facilitate the acquisition and analysis of frequency data processed by a Federal Scientific Model UA-500-1 Ubiquitous Spectrum Analyzer. A control program in an Intellec 8 microprocessor is used to control the rate at which spectrum data are output from the spectrum analyzer. An interface circuit converts the data from serial to parallel format and then latches the data for input by the microprocessor. The microprocessor converts the data from binary format to binary-coded-decimal and then outputs the data on cassette magnetic tape. The spectrum data on cassette magnetic tape can subsequently be read back by the microprocessor and then punched on paper tape in a format suitable for input into the IBM-360 computer system. GRA

N77-20795# Naval Postgraduate School, Monterey, Calif.

THE DESIGN AND IMPLEMENTATION OF A GENERAL PURPOSE INTERACTIVE GRAPHICS SUBROUTINE LIBRARY M.S. Thesis

Barbara Jo Stankowski Sep. 1976 125 p refs

(AD-A032324) Avail: NTIS HC A06/MF A01 CSCL 09/2

This thesis describes the design and implementation of a high level, general purpose, interactive graphics subroutine library for the Vector General Interactive Graphics Display System. The lower interface levels of the system and its effects on the development of this high level interface are discussed. The problems and various approaches associated with the development of a general purpose, high level applications subroutine library that is user oriented are outlined. The basic design goals, solutions and recommendations for further expansion of the system are presented. This graphics subroutine library is implemented within the conventions of the C-Programming language and the UNIX operating system as implemented on the PDP-11/50 in the Naval Postgraduate School Computer Laboratory. GRA

N77-20796# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.

THE UNIFIED PROCESSOR, A MICROPROGRAMMABLE PROCESSOR Final Technical Report, Aug. 1972 - Mar. 1975

Ralph E. Barrera Sep. 1976 89 p refs

(AD-A032180; AFAL-TR-75-148) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report presents the design of a microprogrammable processor called the Unified Processor (UP). First a brief history of microprogramming is given followed by a description of a present day processor. The architecture of the Interpreter is presented along with several deficiencies that were present in its design. A brief discussion of the microprogamming format of the UP is presented followed by an in-depth description of the UP. The features of the UP that are covered include general registers, special registers, internal bussing, microprogram addressing, and the Barrel Switch. Examples of how each of the various features can be used are included in each section. Finally, the UP is evaluated and recommended changes for a future design presented. Author (GRA)

N77-20797# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.

MULTIPURPOSE DIGITAL MICROPROCESSOR EMULATOR

Jerry R. Brookshire 11 May 1976 119 p refs

(AD-A031782; RG-76-62) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report describes an emulator designed and implemented to support the initial software development effort for a multipurpose digital microprocessor, and which also is to provide a vehicle for experimenting with hardware and software architectural changes proposed for the microprocessor. The initial testbed application for the microprocessor is to be the guidance control computer in the T-6 missile. The flight control software will be developed utilizing this emulator. Author (GRA)

N77-20798# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE THERMAL INTERFACE MESSAGE PROCESSOR PROGRAM
Aug. 1976 228 p
(Contracts DAHC15-69-C-0179; F08606-75-C-0032)
(AD-A031617; Tech-INFOR-91) Avail: NTIS HC A11/MF A01 CSCL 09/2

A summary of the Terminal IMP hardware follows. Up to 63 terminals, either remote or local, of widely diverse characteristics may be connected to a given TIP and thereby talk into the network. It is also possible to connect a Host to a TIP in the usual way a Host is connected to an IMP. The TIP is built around a Honeywell H-316 computer with 28K of core. It embodies a standard 16-port multiplexed memory channel with priority interrupts and includes a Teletype for debugging and program reloading. Other features of the standard IMP also present are a real-time clock, power-fail and auto-restart mechanisms, and a program-generated interrupt feature. As in the standard IMP, interfaces are provided for connecting to high-speed (50-kilobit, 230.4-kilobit, etc.) modems as well as to Hosts.GRA

N77-20799# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN INEXPENSIVE ON-LINE ANALOG COMPUTER FOR A WIND TUNNEL Final Report
Anders S. Platou, George I. T. Nielsen, and James B. Harmon Sep. 1976 27 p
(AD-A031422; BRL-MR-2682) Avail: NTIS HC A03/MF A01 CSCL 09/2

An inexpensive analog computer has been developed which can be used for on-line data reduction of pitch and yaw strain-gage balance data during a wind tunnel test. This computer can be used with any size balance, the only restriction being that the multiplication constants of the computer must be tailored or adjusted to the calibration constants of the balance. The existing computer is constructed for any use with any balance having moment bridges for measuring pitch and side forces. The computer reduces the individual bridge signals to forces, transfers the moment to a selected moment center, and also computes the angular sting deflection due to the force and moment acting on the model. Author (GRA)

N77-20800# Naval Research Lab., Washington, D.C. Communications Science Div.
ANOMALOUS BEHAVIOR OF THE FIFTY-PERCENT RULE
John E. Shore Sep. 1976 29 p refs
(AD-A031578; NRL-MR-3368) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper reports simulation data showing that, in dynamic memory allocation, the average free-to-allocated-block ratio can be considerably less than predicted by the fifty-percent rule. A new derivation is given, and it is shown that previous derivations make an implicit assumption that may be violated frequently. Based on the simulation data and on the derivation, it is hypothesized that the anomalous behavior results from the combined effects of systematic placement and the statistics of the release process. Additional simulations supported this hypothesis. Systematic placement, which refers to the natural convention of always allocating storage requests against the same end of the free block selected by the allocation strategy, tends to order blocks within contiguous groups according to their allocation time. The degree of anomalous behavior depends on the extent to which allocated blocks are released in the order of their allocation. For non-Markovian release processes the extent of the correlation between allocation order and release order varies inversely with the coefficient of variation of the memory residence time distribution. For values less than about .8, the free-to-allocated-block ratio can be considerably less than 1/2. For larger values, Knuth's estimate appears to be accurate provided that the average number of allocated blocks is high. Some practical implications are discussed briefly. Author (GRA)

N77-20801# System Development Corp., Santa Monica, Calif.
AIR FORCE GLOBAL WEATHER CENTRAL SYSTEM ARCHITECTURE STUDY. FINAL SYSTEM/SUBSYSTEM SUMMARY REPORT. VOLUME 8: SYSTEM SPECIFICATION Final Report, 1 Feb. 1975 - 1 Mar. 1976
Los Angeles SAMSO 1 Mar. 1976 196 p refs 8 Vol.
(Contract F04701-75-C-0114)
(AD-B010434; SDC-TM-(L)-5613/008/01-Vol-8; SAMSO-TR-76-91-Vol-8) Avail: NTIS HC A09/MF A01 CSCL 09/2

System specifications and architecture for a weather data processor are described. User requirements, operational functions and a proposed component configuration are also examined. Various key features designed for reliability in meeting user requirements are listed. B.B.

N77-20802# System Development Corp., Santa Monica, Calif.
AIR FORCE GLOBAL WEATHER CENTRAL SYSTEM ARCHITECTURE STUDY. FINAL SYSTEM/SUBSYSTEM SUMMARY REPORT. VOLUME 7: IMPLEMENTATION AND DEVELOPMENT PLANS Final Report, 1 Feb. 1975 - 1 Mar. 1976
Los Angeles SAMSO 1 Mar. 1976 96 p 8 Vol.
(Contract F04701-75-C-0114)
(AD-B010433; SDC-TM-(L)-5613/007/01-Vol-7; SAMSO-TR-76-90-Vol-7) Avail: NTIS HC A05/MF A01 CSCL 09/2

Design development and logistics schedule, system cost considerations, risk analysis, and system verification planning are presented. GRA

N77-20803# System Development Corp., Santa Monica, Calif.
AIR FORCE GLOBAL WEATHER CENTRAL SYSTEM ARCHITECTURE STUDY. FINAL SYSTEM/SUBSYSTEM SUMMARY REPORT. VOLUME 5: SYSTEM DESCRIPTION Final Report, 1 Feb. 1975 - 1 Mar. 1976
1 Mar. 1976 128 p 8 Vol.
(Contract F04701-75-C-0114)
(AD-B010431; SDC-TM-(L)-5613/005/01-Vol-5; SAMSO-TR-76-88-Vol-5) Avail: NTIS HC A07/MF A01 CSCL 09/2

The system described has a number of unique features, including total hardware authentication separation of security levels, load leveling accomplished by assigning main processors in accordance with a dynamic priority queue of tasks, and a system-wide network control capability. Other key features include a central data base processor to fill requests for data from other processors, computer operations centers, the use of array processors for accomplishing difficult numerical problems, and sophisticated forecaster console support. These elements have been designed to provide a 99.5% reliability in meeting user requirements. The proposed system architecture consists of five dual processors each of which is about 3.5 times as powerful as an existing AFGWC processor (a Univac 1108). Each dual processor has an array processor which is capable of very high performance on vector arithmetic. Author (GRA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-20804# Oak Ridge National Lab., Tenn. Computer Sciences Div.
CATCH: COMPUTER ASSISTED TOPOGRAPHY, CARTOGRAPHY, AND HYPSOGRAPHY. PART 1: MAPROJ: A SUBROUTINE PACKAGE FOR A NUMBER OF COMMON MAP PROJECTIONS
T. C. Tucker Jun. 1976 69 p refs Sponsored in part by EPA

(Contracts W-7405-eng-26; NSF AAA-R-4-79)
(ORNL/TM-3790-Pt-1) Avail: NTIS HC A04/MF A01

In the collection are the Albers equal area, the Lambert conformal, the Universal Transverse Mercator, the U.S. Polyconic, and the various state plane coordinate systems. Optional, higher-level subroutines are provided to allow specifying the projection by input data. In addition, there is a general quadrilateral transformation subroutine which is useful for translation, rotation, scaling, and even approximate projections. ERA

N77-20805# Oak Ridge National Lab., Tenn.
IUCALC: A FORTRAN SUBROUTINE FOR CALCULATING POLYGON-LINE INTERSECTIONS, AND POLYGON-POLYGON INTERSECTIONS, UNIONS, AND RELATIVE DIFFERENCES
R. G. Edwards and P. R. Coleman Aug. 1976 35 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-12) Avail: NTIS HC A03/MF A01

The IBM 360 FORTRAN Subroutine IUCALC may be used to calculate polygon--chain (of line segments) intersections and polygon--polygon intersections, unions, and relative differences. The subroutine is used in computer-assisted geographical analysis involving areal quantities defined in terms of polygons. The subroutine is also used in producing choropleth (shaded) displays of polygon or gridded data. ERA

N77-20806# Oak Ridge National Lab., Tenn.
MAPPROJ2: FORTRAN MAP PROJECTION SUBROUTINES, VERSION 2
R. G. Edwards Aug. 1976 47 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-10) Avail: NTIS HC A03/MF A01

The FORTRAN subroutine library MAPPROJ2 provides latitude--longitude--northing--easting transformations for Lambert, Albers, Polyconic, and Transverse-Mercator map projections. Four transformations are provided for each projection: latitude--longitude to northing--easting, northing--easting to latitude--longitude, latitude--easting to northing--longitude, and northing--longitude to latitude--easting. Two additional parametric pseudo-projections are provided, one for the various UTM zones, and the other for state plane definitions. Two versions of the routines are available, one for IBM 360 computers, the second for the PDP-10.1 table. ERA

N77-20807# Battelle Pacific Northwest Labs., Richland, Wash.
DIGRTS: A COMPUTER CODE FOR STUDYING THE DIFFUSION OF AN INERT GAS IN COMPOSITE SOLIDS WITH REVERSIBLE TRAPPING
C. A. Oster Feb. 1976 67 p refs
(Contract E(45-1)-1830)
(BNWL-1987) Avail: NTIS HC A04/MF A01

DIGRTS is a computer program for calculating the concentration distribution of an inert gas diffusing through a composite solid which permits reversible trapping of the gas atoms. The program is coded entirely in FORTRAN IV. The composite solid can consist of up to ten regions. These regions are further subdivided in a manner so that the total number of nodes (subdivision points) is less than or equal to 200. The code can readily be modified should these limits be undersirable. The code permits only constant parameters for describing the diffusion process but the extension to allow time dependent parameters is clearly marked in the program. In addition to calculations of the concentration distributions, the time dependent release fraction is also computed. ERA

N77-20808# Logicon, Inc., Dayton, Ohio.
MANAGEMENT GUIDE TO AVIONICS SOFTWARE ACQUISITION. VOLUME 3: SUMMARY OF SOFTWARE RELATED STANDARDS AND REGULATIONS Final Report, Jan. 1975 - May 1976
Jun. 1976 59 p
(Contract F33657-76-C-0234; AF Proj. 2257)
(AD-A030593; R-RW-75002-3-Vol-3; ASD-TR-76-11-Vol-3)
Avail: NTIS HC A04/MF A01 CSCL 01/3

Summary of Software Related Standards and Regulations. This volume is an aid for effective use of existing Air Force Regulations and Military Standards. It provides an interpretation and summary of the applicable software portions of these controlling documents for the project manager. GRA

N77-20809# Logicon, Inc., Dayton, Ohio.
MANAGEMENT GUIDE TO AVIONICS SOFTWARE ACQUISITION. VOLUME 4: TECHNICAL ASPECTS RELATIVE TO SOFTWARE ACQUISITION Final Report, Jan. 1975 - May 1976
Jun. 1976 167 p refs
(Contract F33657-76-C-0234; AF Proj. 2257)
(AD-A030594; R-RW-75002-4-Vol-4; ASD-TR-76-11-Vol-4)
Avail: NTIS HC A08/MF A01 CSCL 01/3

Summary of Technical Aspects Relative to Software Acquisition. This volume presents basic technical information which will aid in the appreciation of the complexities of avionics software acquisition. It provides the project manager with a deeper understanding of computer hardware/software interfaces and software design. Author (GRA)

N77-20810# Maryland Univ., College Park. Dept. of Computer Science.
AN ALGORITHM FOR COMPUTING REDUCING SUBSPACES BY BLOCK DIAGONALIZATION
Connice A. Bavely and G. W. Stewart Oct. 1976 46 p refs
(Contract N00014-76-C-0391)
(AD-A032013; TR-489) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper describes an algorithm for reducing a real matrix A to block diagonal form by a real similarity transformation. The columns of the transformation corresponding to a block span a reducing subspace of A, and the block is the representation of A in that subspace with respect to the basis. The algorithm attempts to control the condition of the transformation matrices, so that the reducing subspaces are well conditioned and the basis vectors are numerically independent. Author (GRA)

N77-20811# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
SHORTEST ROUTE ALGORITHMS FOR SPARSELY CONNECTED NETWORKS
Joe E. Defenderfer Aug. 1976 73 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A032134; ESL-R-683) Avail: NTIS HC A04/MF A01 CSCL 12/2

This report studies the shortest route problem for networks that are less fully connected. Two algorithms are presented which exploit the absence of arcs in solving the shortest route problem. The first, which is designated the NXN algorithm, would tend to be the more applicable to networks typically encountered in practice. The second, which is an improvement on Hu's decomposition shortest route algorithm, is more efficient for a small class of networks; however, it generally requires less memory to hold the required decomposition information in the computer than does the NXN algorithm. Author (GRA)

N77-20812# Wisconsin Univ., Madison. Mathematics Research Center.
A PRODUCT VERSION OF A VARIABLE METRIC METHOD AND ITS CONVERGENCE PROPERTIES Technical Summary Report
Klaus Ritter Sep. 1976 25 p refs
(Contract DAAG29-75-C-0024)
(AD-A031973; MRC-TSR-1677) Avail: NTIS HC A02/MF A01 CSCL 12/1

A product version of a variable metric method is described. It is shown that it converges superlinearly. Author (GRA)

N77-20813# Naval Surface Weapons Center, Dahlgren, Va.
COMPUTATION OF THE INCOMPLETE GAMMA FUNCTION RATIOS Final Report
A. R. DiDonato and R. K. Hageman Apr. 1976 86 p refs
(AD-A031812; NSWC/DL-TR-3482) Avail: NTIS HC A05/MF A01 CSCL 12/1

A method, made up of several algorithms, is given for computing the incomplete gamma function ratio, P(a, x) and its complement Q(a, x) for all real arguments $a = 0$, $x < \text{or} = 0$. The difficult case when a and x are large is treated by a modified version of Takenaga's method. The resulting computer program

is efficient, yields both P and Q correctly to within 1 unit in the twelfth significant digit, or, at the user's option, to within one unit in the sixth or third significant digit. A FORTRAN listing of the program is included. GRA

N77-20814# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

A SYSTEM FOR UNDERSTANDING MATHEMATICAL FORTRAN PROGRAMS

Richard C. Waters Aug. 1976 80 p refs Revised

(Contract N00014-75-C-0643)

(AD-A031884; AI-M-368) Avail: NTIS HC A05/MF A01 CSCL 09/2

This paper proposes a system which, when implemented, will be able to understand mathematical FORTRAN programs, such as those in the IBM Scientific Subroutine Package. The system takes, as input, a program and annotation of the program. In order to understand the program, the system develops a 'plan' for it. The plan specifies the purpose of each feature of the program, and how these features cooperate in order to create the behavior exhibited by the program. The system can use its understanding of the program to answer questions about it including questions about the ramifications of a proposed modification. It is also able to aid in debugging the program by detecting errors in it, and by locating the features of the program which are responsible for an error. The system should be of significant assistance to a person who is writing a program. GRA

N77-20815# Stanford Univ., Calif. Dept. of Computer Science.

THE EARLY DEVELOPMENT OF PROGRAMMING LANGUAGES

Donald E. Knuth and Luis Trabb Pardo Aug. 1976 112 p refs

(Contract N00014-76-C-0330; Grant NSF MCS-72-03752)

(AD-A032123; SU-STAN-CS-76-562) Avail: NTIS HC A06/MF A01 CSCL 09/2

This paper surveys the evolution of high level programming languages during the first decade of computer programming activity. We discuss the contributions of Zuse (Plankalkul, 1945), Goldstine/von Neumann (Flow Diagrams, 1946), Curry (Composition, 1948), Mauchly et al. (Short Code, 1950), Burks (Intermediate PL, 1950), Rutishauser (1951), Bohm (1951), Glennie (AUTOCODE, 1952), Hopper et al. (A-2, 1953), Laning/Zierler (1953), Backus et al. (FORTRAN, 1954-1957), Brooker (Mark I Autocode, 1954), Kamynin/Liubimskii (P.P., 19654), Ershov (P.P., 1955), Grems/Porter (Bacaic, 1955), Elsworth et al. (Kompiler 2, 1955), Blum (ADES, 1956), Perlis et al. (IT, 1956), Katz et al. (MATH-MATIC, 1956-1958), Hopper et al. (FLOW-MATIC, 1956-1958), Bauer/Samelson (1956-1958). The principal features of each contribution are illustrated; and for purposes of comparison, a particular fixed algorithm has been encoded (as far as possible) in each of the languages. This research is based primarily on unpublished source materials, and the authors hope that they have been able to compile a fairly complete picture of the early developments in this area. This article was commissioned by the Encyclopedia of Computer Science and Technology, edited by Jack Belzer, Albert G. Holzman, and Allen Kent, and it is scheduled to appear in vol. 6 or vol. 7 of that encyclopedia during 1977. Author (GRA)

N77-20816# Desmatics, Inc., State College, Pa.

OPTIMIZATION OF A COMPUTER SIMULATION RESPONSE

Dennis E. Smith Nov. 1976 40 p refs Presented at the ORSA/TIMS Joint Natl. Meeting, Miami, 3-5 Nov. 1976

(Contract N00014-75-C-1054)

(AD-A032051; TR-106-3) Avail: NTIS HC A03/MF A01 CSCL 09/2

Based on results to date, the statistical techniques of Response Surface Methodology (RSM) appear to be well-adapted to use in seeking an optimum simulation response. This report summarizes the optimum-seeking problem, reviews the framework of RSM, and describes an automated RSM computer program which has been developed as an alternative to manual applications of these statistical techniques. Program interface and data preparation are discussed. In addition, easily-followed examples are presented to illustrate program output and major aspects of the RSM optimum-seeking process. Author (GRA)

N77-20817# Wisconsin Univ., Milwaukee. Dept. of Electrical Engineering and Computer Science.

PROGRAMMING LANGUAGE STUDIES. 1. THE POWER OF CONTROL STRUCTURES AND DATA STRUCTURES Final Report, 1 Jun. 1974 - 1 Sep. 1976

Richard DeMillo, Stanley Eisenstat, and Richard Lipton Aug. 1976 112 p refs

(Contract DAHC04-74-G-0179)

(AD-A032043; TR-CS-76-13; ARO-12142.8-M) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report seeks to provide the basis for a quantitatively precise theory of the relative power of programming language control structures and data structures. The first of a two-part series, it concentrates on the relative power of programming language structures, while part 2 will deal with the relationship of language structures to program verification. This report is a collection of the papers produced under the above grant. The papers have been organized to clearly expose the central concept treated in this research: graph embeddings and their relationship to programming languages. GRA

N77-20818# Naval Postgraduate School, Monterey, Calif.

SOFTWARE DESIGN FOR A FATIGUE MONITORING DATA ACQUISITION SYSTEM M.S. Thesis

Charles Lynn Butler Sep. 1976 74 p refs

(AD-A031816) Avail: NTIS HC A04/MF A01 CSCL 01/3

The software for an aircraft fatigue monitoring data acquisition system was designed and implemented on a prototype instrument to evaluate the feasibility of employing such a system in the data collection process for the determination of fatigue effects in aircraft structures. The operating software and the associated hardware are described herein; options for actual implementation in light of rapid technological developments are hypothesized and discussed. Separate software packages provide for the data collection and retrieval, including the pre-processing of data to a form which is suitable for computation. Results of test cases are presented where the software is proved by comparison of output to controlled input signals. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N77-20819# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.

AVOIDING DELAY-FREE LOOPS IN THE SYNTHESIS OF TIME-DISCRETE SYSTEMS [UEBER DIE VERMEIDUNG VERZOEGERUNGSFREIER SCHLEIFEN BEI DER SYNTHESE ZEITDISKRETER SYSTEME]

Raimund Luecker May 1976 31 p refs In GERMAN

(IND-FB-88) Avail: NTIS HC A03/MF A01

A synthesis method is discussed for time-discrete systems, allowing the realization of a desired input-output behavior without prescription of a special structure. It is shown that delay-free loops can be avoided by suitable control of the method. ESA

N77-20820# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.

SYNTHESIS OF TIME-DISCRETE SYSTEMS UNDER CONSIDERATION OF STATE VARIABLES [SYNTHESE ZEITDISKRETER SYSTEME UNTER BERUECKSICHTIGUNG DER ZUSTANDSGROESSEN]

Raimund Luecker May 1976 22 p refs In GERMAN

(IND-FB-90) Avail: NTIS HC A02/MF A01

A method for the synthesis of time-discrete systems, based on matrix operations, is dealt with. It is shown that a systems description in the state space, the state structure matrix, may be obtained as an intermediate result of the synthesis process by control of the synthesis steps. ESA

N77-20821# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

TOPICS IN THE STUDY OF INTERCONNECTED SYSTEMS
Evangelos F. Mageirou Jul. 1976 159 p refs
(Contract N00014-75-C-0648; Grant NSF GK-31511)
(AD-A031565; TR-664) Avail: NTIS HC A08/MF A01 CSCL 12/2

This report deals with the stability, stabilization and optimization of systems which can be meaningfully viewed as an interconnection of smaller subsystems. We consider systems whose properties can be determined by examining the corresponding properties of the subsystems and their interconnections rather than the system as a whole. The relevance of such systems to any theory of large scale systems is evident. We present some formulations of the weak interconnection concept in Section 2 in the context of stability studies of economic models. It is shown how the modelling of an economy requires the consideration of systems formed by suitably bounded interconnections of stable subsystems. Lyapunov's second method is employed to unify numerous results as well as to provide interesting extensions. The problem of decentralized stabilization is reduced to an infinite duration linear quadratic game, a complete solution of which is given in Section 5. As expected, Riccati-type equations play an important role in such problems. This role is clarified in Section 5. Section 3 deals with the comparison of the solutions of optimal control problems for interconnected systems. The theory of dynamic programming and the Hamilton Jacobi Bellman equation is the main tool used. In addition, the same theory is applied to an extensive study of optimization algorithms, the main result being the extension of the applicability of the well-known Kleinman algorithm for the Riccati equation to cover the ones encountered in Sections 4 and 5. GRA

N77-20822# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
A NOTE ON A NONLINEAR MINIMAX LOCATION PROBLEM ON A TREE NETWORK
Richard L. Francis Oct. 1976 20 p refs
(Grant DAHC04-75-G-0150)
(AD-A032065; RR-76-23; ARO-12640.15-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Some new derivations are presented, which are rather short, and direct, of properties of a nonlinear version of a minimax tree network location problem. The properties provide necessary and sufficient conditions for optimality, a means of computing the optimum objective function value, and a means of constructing the unique optimum location. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N77-20823# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
COOPERATIVE COMPUTATION OF STEREO DISPARITY
David Marr and Tomaso Poggio Jun. 1976 21 p refs
(Contract N00014-75-C-0643)
(AD-A030748; AI-M-364) Avail: NTIS HC A02/MF A01 CSCL 06/4

The extraction of stereo disparity information from two images depends upon establishing a correspondence between them. This article analyzes the nature of the correspondence computation, and derives a cooperative algorithm that implements it. It is shown that this algorithm successfully extracts information from random-dot stereograms, and its implications for the psychophysics and neurophysiology of the visual system are briefly discussed. GRA

N77-20824# Naval Training Equipment Center, Orlando, Fla. Electronics and Acoustics Lab.
OBJECTIVE EVALUATION METHOD FOR SIMULATED VISUAL SCENES, PRELIMINARY ANALYSIS Technical Note, Jun. - Aug. 1973
Klaus Lindenberg Aug. 1976 34 p refs
(AD-A031281; NAVTRAEQUIPC-TN-47) Avail: NTIS HC A03/MF A01 CSCL 09/2

A performance criterion or set of criteria is needed to provide a means for the objective quantitative appraisal of image content of the simulated visual environment as displayed to a trainee. A preliminary analysis of the problem examined two areas. First, it identified those characteristics of the electrooptical imaging system which most directly affect image quality, and second, it identified the techniques of image manipulation derived from the general areas of pattern recognition and biomedical image processing. The Modulation Transfer Function Area (MTFA) has been proposed as a physical measure of image quality for comparing the relative quality of a number of imaging systems. Techniques found successful in raising the apparent quality of digital imagery could serve as trial bases for quality criteria. Two techniques directly attributable to pattern recognition, the correlation analysis, and the Haar transformation are proposed. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-20825*# Maryland Univ., College Park. Dept. of Electrical Engineering.
OPTIMAL ESTIMATION FOR DISCRETE TIME JUMP PROCESSES
Marco V. Vaca and Steven A. Tretter 25 Mar. 1977 30 p refs
(Grant NsG-5048)
(NASA-CR-152620) Avail: NTIS HC A03/MF A01 CSCL 12A

Optimum estimates of nonobservable random variables or random processes which influence the rate functions of a discrete time jump process (DTJP) are obtained. The approach is based on the a posteriori probability of a nonobservable event expressed in terms of the a priori probability of that event and of the sample function probability of the DTJP. A general representation for optimum estimates and recursive equations for minimum mean squared error (MMSE) estimates are obtained. MMSE estimates are nonlinear functions of the observations. The problem of estimating the rate of a DTJP when the rate is a random variable with a probability density function of the form cx super K (l-x) super m and show that the MMSE estimates are linear in this case. This class of density functions explains why there are insignificant differences between optimum unconstrained and linear MMSE estimates in a variety of problems. Author

N77-20826# Illinois Univ., Urbana. Dept. of Computer Science.
BLENDED LINEAR MULTISTEP METHODS
Robert D. Skeel and A. K. Kong Jun. 1976 73 p refs
(Contract AT(11-1)-2383)
(COO-2383-0030; UIUCDCS-R-76-800) Avail: NTIS HC A04/MF A01

The accuracy of linear multistep formulas suitable for stiff differential systems is limited. Greater accuracy can be attained by including higher derivatives in the formula, but this is not practical for all problems. It is possible, however, to duplicate the absolute stability region for any given m-derivative multistep formula by taking a linear combination of m multistep formulas. These blended formulas are similar to Lambert and Sigurdsson's linear multistep formulas with variable matrix coefficients, but the approach is different. Implementation details and numerical results are presented for a variable-order, variable-step blend of the Adams-Moulton and the backward differentiation formulas. ERA

N77-20827# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
SINGULARITIES PROBLEM IN THE FINITE ELEMENT METHOD
I. Babuska Jun. 1976 49 p refs
(Contract AT(40-1)-3443)
(ORO-3443-61) Avail: NTIS HC A03/MF A01

The problem of the influence of a nonsmooth boundary or interfaces on the convergence of the finite element method is

important from the theoretical and practical points of view. In the case of linear problems, important results have been obtained recently. However, there are only a very few results which are related to the nonlinear problems. This paper attempts a survey of the current known results related to the problem of singular behavior of elliptic equations, especially with respect to numerical solutions. An extensive list of references is given. GRA

N77-20828# California Univ., Livermore. Lawrence Livermore Lab.

COMPUTER IMPLEMENTATION OF GLIMM'S METHOD

Gary A. Sod Aug. 1976 30 p refs

(Contract W-7405-eng-48)

(UCID-17252) Avail: NTIS HC A03/MF A01

Glimm's method deals with the solution of a nonlinear hyperbolic equation. The method is rooted in the constructive proof by Glimm that such systems have weak solutions. The Riemann problem is examined. The iterative method of Godunov, the selection of random numbers, and the actual implementation of Glimm's method are discussed. Usage of the FORTRAN subroutine GLIMM is explained; a flow chart is provided. Graphical results are presented for three shock tube problems with 100 spatial grid points. The time for a typical problem is 10 seconds on a CDC 7600 computer. ERA

N77-20829# Royal Netherlands Meteorological Inst., De Bilt.

AVERAGES AND STANDARD DEVIATIONS OF VECTOR MAGNITUDES AND THEIR MUTUAL RELATIONSHIPS [GEMIDDELDEN EN STANDARD DEVIATIES VAN VECTOR GROOTHEDEN EN HUN ONDERLIGE RELATIES]

P. J. Rijkoort 1976 19 p In DUTCH

(KNMI-V-281) Avail: NTIS HC A02/MF A01

The relationships are discussed with particular reference to wind speed variability. The precision of the formulas derived for two different models was checked using numerical methods. ESA

N77-20830# National Bureau of Standards, Washington, D.C.

UNIFORM ASYMPTOTIC EXPANSIONS AND SINGULAR PERTURBATIONS Final Report

F. W. J. Olver 1976 14 p refs Repr. from the SIAM-AMS Proceedings, vol. 10, 1976 p 105-117

(Grant DA-ARO(D)-31-124-73-G204; NSF GP-32841)

(PB-259848/0) Avail: NTIS HC A02/MF A01 CSCL 12A

A brief account is given of an investigation into the asymptotic nature of the solution of the boundary-value problem, epsilon(y double prime) + 2xA(epsilon,x)y prime A(epsilon,x)B(epsilon,x)y = 0, y(a) = 1, y(b) = m, as epsilon approaches 0, where A(epsilon x, and B(epsilon,x) are continuous real functions of epsilon and x, a. o, b is greater than 0, and A(epsilon,x) is nonzero in (a,b). Particular attention is paid to the problem of resonance, which arises when the limiting form of the solution exhibits an unusual lack of decay. GRA

N77-20831# Sydney Univ. (Australia). Civil Engineering Labs.

NUMERICAL SOLUTION OF RAFTS ON VISCOELASTIC MEDIA USING LAPLACE TRANSFORMS

P. T. Brown and J. R. Booker Jul. 1976 28 p

(PB-259618/7; R-289) Avail: NTIS HC A03/MF A01 CSCL 20L

Problems of a raft on a viscoelastic half-space are converted to equivalent elastic problems by means of a Laplace transformation, and a numerical solution is obtained by finite element techniques. It is shown that the solution can be expressed in terms of an eigenvector expansion, and this solution is then transformed back to obtain a numerical solution to the original problem. The method allows an explicit solution to the original problem when the creep function can be modeled by springs and dashpots, and allows the solution of the problem to be reduced to a series of Volterra integral equations for the case of creep functions which cannot be modeled in this way. The method is illustrated by results for rectangular and circular rafts, and particular attention is paid to a realistic soil creep function which is asymptotic to a linear function of log time. GRA

N77-20832# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

A CONVERSE FOR DISJUNCTIVE CONSTRAINTS

C. E. Blair and R. G. Jeroslow Jun. 1976 12 p refs

(Contract N00014-75-C-0621; Grant NSF GP-37510)

(AD-A032275; RR-393) Avail: NTIS HC A02/MF A01 CSCL 12/2

A necessary and sufficient condition is given, for the disjunctive constraints construction to provide all valid cuts for a system of logical constraints on linear inequalities. Author (GRA)

N77-20833# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

ALL ALGEBRAIC FUNCTIONS CAN BE COMPUTED FAST Interim Report

H. T. Kung and J. F. Traub Jul. 1976 46 p refs

(Contract N00014-76-C-0370; Grant NSF MCS-75-222-55; NR Proj. 044-422)

(AD-A032345) Avail: NTIS HC A03/MF A01 CSCL 12/1

The expansions of algebraic functions can be computed 'fast' using the Newton Polygon Process and any 'normal' iteration. Let M(j) be the number of operations sufficient to multiply two jth degree polynomials. It is shown that the first N terms of an expansion of any algebraic function defined by an nth degree polynomial can be computed in O(n(M(N)) operations, while the classical method needs O(N sup n) operations. Among the numerous applications of algebraic functions are symbolic mathematics and combinatorial analysis. Reversion, reciprocation, and nth root of a polynomial are all special cases of algebraic functions. GRA

N77-20834# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

COMPUTATIONAL COMPLEXITY OF ONE-STEP METHODS FOR THE NUMERICAL SOLUTION OF INITIAL VALUE PROBLEMS Ph.D. Thesis

Arthur Gustav Werschulz Sep. 1976 88 p refs

(Contract N00014-76-C-0370; Grant NSF MCS-75-222-55; NR Proj. 044-422)

(AD-A032346) Avail: NTIS HC A05/MF A01 CSCL 12/1

The task of numerically approximating the solution of an ordinary differential equation initial-value problems is discussed. Two questions are considered: (1) For any given one-step method, what is the complexity of finding an approximate solution with error less than epsilon. (2) Given an infinite sequence of one-step methods of increasing order, how should the method and the step-size be picked so as to minimize the complexity of finding such an approximation. A methodology is described that handles both questions. It is found that within such a sequence of methods, the following hold under very general circumstances: For any epsilon, 0 - epsilon - 1, there is a unique choice of order and step-size which minimizes the complexity. (2) As epsilon decreases, both the optimal order and the complexity increase monotonically, tending to infinity as epsilon tends to zero. These results are applied to several classes of one-step methods. In doing so, some new Taylor series methods are used that are asymptotically better than Runge-Kutta methods for problems of small dimension. Moreover, it is proven that among all classes of nonlinear Runge-Kutta methods, those due to Brent have the highest order possible. GRA

N77-20835# Stanford Univ., Calif. Dept. of Computer Science.

AN INTRODUCTION TO BOOLEAN FUNCTION COMPLEXITY

Michael S. Phaterson Aug. 1976 22 p refs

(Contract N00014-76-C-0330; Grant NSF MCS-72-03752)

(AD-A032122; STAN-CS-76-557) Avail: NTIS CSCL 12/1

The complexity of a finite Boolean function may be defined with respect to its computation by networks of logical elements in a variety of ways. The three complexities of circuit size, formula size and depth are considered, and some of the principal results concerning their relationships and estimations are presented, with outlined proofs for some of ths simpler theorems. This survey is restricted to networks in which all two-argument logical functions may be used. GRA

N77-20836# Stanford Univ., Calif. Dept. of Computer Science.

RANK DEGENERACY AND LEAST SQUARES PROBLEMS

Gene Golub, Virginia Klema (Maryland Univ. College Park), and G. W. Stewart Aug. 1976 42 p refs
(Contract N00014-76-C-0391; Grants NSF DCR-75-08802; DAHC04-75-G-0185; NSF DCR-75-13497)
(AD-A032348; STAN-CS-76-559) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with least squares problems when the least squares matrix A is near a matrix that is not of full rank. A definition of numerical rank is given. It is shown that under certain conditions when A has numerical rank r there is a distinguished r dimensional subspace of the column space of A that is insensitive to how it is approximated by r independent columns of A. The consequences of this fact for the least squares problem are examined. Algorithms are described for approximating the stable part of the column space of A. GRA

N77-20837# Wisconsin Univ., Madison. Mathematics Research Center.
SPECTRAL PROPERTIES AND OSCILLATION THEOREMS FOR MIXED BOUNDARY-VALUE PROBLEMS OF STURM-LIOUVILLE TYPE
J. W. Lee (Oreg. State Univ.) and A. Pinkus Sep. 1976 44 p refs
(Contract DAAG29-75-C-0024)
(AD-A031945; MRC-TSR-1683) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents analogues of the spectral and oscillatory properties exhibited by classical Sturm-Liouville systems for certain mixed boundary value problems that include periodic boundary conditions as a special case. These mixed boundary-value problems have Green's functions which are sign consistent for all even and/or odd orders. Author (GRA)

N77-20838# Wisconsin Univ., Madison. Mathematics Research Center.
SPLINES AS LINEAR COMBINATIONS OF B-SPLINES. A SURVEY
Carl DeBoor Aug. 1976 50 p refs
(Contract DAAG29-75-C-0024)
(AD-A031944; MRC-TSR-1667) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is intended to promote the point of view that B-splines are truly basic splines: B-splines express the essentially local, but not completely local, character of splines; certain facts about splines take on their most striking form when put into B-spline terms, and many theorems about splines are most easily proved with the aid of B-splines; the computational determination of a specific spline from some information about it is usually facilitated when B-splines are used in its construction. GRA

N77-20839# Wisconsin Univ., Madison. Mathematics Research Center.
A SURVEY OF M-MATRIX CHARACTERIZATIONS. 1: NONSINGULAR M-MATRICES Summary Report
R. J. Plemmons Jul. 1976 25 p refs
(Contracts DAAG29-75-C-0024; DAHC04-74-C-0019)
(AD-A031963; MRC-TSR-1651) Avail: NTIS HC A02/MF A01 CSCL 12/1

The purpose of this survey is to classify systematically a widely ranging list of characterizations of nonsingular M-matrices from the economics and mathematics literatures. These characterizations are grouped together in terms of their relationships to the properties of (1) positivity of principal minors (2) inverse-positivity and splittings (3) stability and (4) semi-positivity and diagonal dominance. A list of forty equivalent conditions is given for a square matrix A with nonpositive off-diagonal entries to be a nonsingular M-matrix. These conditions are grouped into classes in order to identify those that are equivalent for arbitrary real matrices A. In addition, other remarks relating nonsingular M-matrices to certain complex matrices are made and the recent literature on these general topics is surveyed. Author (GRA)

N77-20840# Wisconsin Univ., Madison. Mathematics Research Center.
DUALITY IN NONCONVEX OPTIMIZATION AND CALCULUS OF VARIATIONS
Ivar Ekeland Sep. 1976 59 p refs
(Contract DAAG29-75-C-0024)
(AD-A031953; MRC-TSR-1675) Avail: NTIS HC A04/MF A01 CSCL 12/1

A general duality theory is given for smooth nonconvex optimization problems, covering both the finite-dimensional case and the calculus of variations. The results are quite similar to the convex case; in particular, with every problem (P) is associated a dual problem (P^*) having opposite value. GRA

N77-20841# Texas Univ., Austin. Center for Cybernetic Studies.
EXTREMAL PRINCIPLES AND OPTIMIZATION DUALITIES FOR KHINCHIN-KULLBACK-LEIBLER ESTIMATION
A. Charnes, W. W. Cooper (Harvard Univ.), and L. Seiford Apr. 1976 18 p refs
(Contract N00014-75-C-0569; NR Proj. 047-021)
(AD-A031398; CCS-261) Avail: NTIS HC A02/MF A01 CSCL 12/2

This paper presents a new extremal approach to deriving dual optimization problems with proper duality inequality which simplifies and gefleralizes the Fenchel-Rockafellar scheme. Our derivation proceeds in two stages, (1) inequality attainment, (2) decoupling primal and dual variables. The power and convenience of this approach are exhibited through a new, much simpler derivation of the Charnes-Cooper results for Khinchin-Kullback-Leibler statistical estimation (1), the immediate establishment of the C(2) duality for general distributions and its extensions to general linear inequality constraints, plus the development of a new two-person zero-sum game connection. GRA

N77-20842# Texas Univ., Austin. Center for Cybernetic Studies.
LEAST ABSOLUTE VALUE ESTIMATORS FOR ONE-WAY AND TWO-WAY TABLES
R. D. Armstrong and E. L. Frome Jun. 1976 36 p refs
(Contract N00014-75-C-0569; NR Proj. 047-021)
(AD-A031399; CCS-266) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper concerns itself with the problem of estimating the parameters in a one-way and two-way classification model by minimizing the sum of the absolute deviations of the regression function from the observed points. The one-way model reduces to obtaining a set of medians from which optimal parameters can be obtained by simple arithmetic manipulations. The two-way model is transformed into a specially structured linear programming problem and two algorithms are presented to solve this problem. The occurrence of alternative optimal solutions in both models is discussed, and numerical examples are presented. Author (GRA)

N77-20843# Wisconsin Univ., Madison. Mathematics Research Center.
AN IMPLICIT-FUNCTION THEOREM FOR GENERALIZED VARIATIONAL INEQUALITIES
Stephen M. Robinson Sep. 1976 33 p refs
(Contract DAAG29-75-C-0024; Grant NSF DCR-74-20584)
(AD-A031952; MRC-TSR-1672) Avail: NTIS HC A03/MF A01 CSCL 12/2

An implicit-function theorem is established for a multifunction consisting of the sum of a differentiable function and a maximal monotone operator. Applications to nonlinear complementarity problems, mathematical programming problems, and economic equilibria are pointed out. An application to the analysis of a general Newton method for solving variational inequalities is treated in some detail. Author (GRA)

N77-20844# Harry Diamond Labs., Adelphi, Md.
SMOOTH EXTENSION OF FUNCTIONS KNOWN AT DISCRETE POINTS: APPLICATION TO MAGNETIC SIGNATURE MEASUREMENTS
Nick Karayianis Oct. 1976 19 p refs
(DA Proj. 1W3-62616-AH-77)
(AD-A030347; HDL-TR-1744) Avail: NTIS HC A02/MF A01 CSCL 17/6

Magnetic signature measurements of tanks at Aberdeen, Md., are taken that effectively measure the vertical field in a plane below the tank at points spaced 1 ft apart in a 20 x 40 ft grid. By use of a discrete Fourier series expansion, the measurements A(pq) are extended to arbitrary points within the area by

R(uv) where R(pq) = A(pq) for integer p,q. This extension allows one to compare sets of measurements that are slightly shifted with respect to one another. Formulas are given by which one may calculate these shifts explicitly if they are assumed small, as well as obtain them by minimizing the square deviation between two functions for arbitrary shifts. Author (GRA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-20845# California Univ., Livermore. Lawrence Livermore Lab.

NUCLEAR EMP: TABLES OF CONFIDENCE BOUNDS FOR FAILURE PROBABILITIES

J. G. Huebel and G. K. Myers Jun. 1976 51 p refs
(Contract W-7405-eng-48)
(PEM-51) Avail: NTIS HC A04/MF A01

The problems are discussed for determining population failure level bounds from sample failure levels and how confidence is influenced by sample size. Two sets of failure probability confidence bounds are tabulated. One set is derived for normally distributed populations and is based on the noncentral t distribution. The other set is derived nonparametrically - that is, without assuming the population distribution - and is based on the binomial distribution. These tables convert sample failure levels into population failure probability bounds. The tables are designed to be easily used and, consequently, are not set in the most compact format. ERA

N77-20846# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

ON THE DISTRIBUTION OF SOME STOCHASTIC COMPARTMENTAL MODELS HAVING TIME-DEPENDENT TRANSITION PROBABILITIES, WITH APPLICATIONS TO RELIABILITY Ph.D. Thesis

Jon Ohman Epperson Aug. 1976 128 p refs
(AD-A031751; AFIT-CI-77-7) Avail: NTIS HC A07/MF A01 CSCL 12/1

The cumulant generating functions of some multi-compartment stochastic models having time-dependent transition rates are derived. Using these, the first and second moments of the stochastic distributions are found. Under certain assumptions concerning the initial conditions the stochastic distributions are specifically identified. The models investigated are the n-compartment mixed catenary-mammillary model and the n-compartment general irreversible model. These derivations are then used to analyze some reliability systems. In particular, the catenary portion of the mixed model is used to obtain stochastic analyses of a standby redundant system. The mixed model is used for a system wherein a component is subject to competing-risks with standby components. The general model is employed to evaluate a mission reliability with hierarchical failure structure. Author (GRA)

N77-20847# California Univ., Berkeley. Operations Research Center.

MULTIVARIATE LIFE TABLE ANALYSIS

Richard E. Barlow and Frank Proschan (Fla. State Univ., Tallahassee) Apr. 1976 22 p refs
(Contracts N00014-75-C-0781; AT(49-24)-0147; Grant AF-AFOSR-2581-74; NR Proj. 042-238)
(AD-A031927; ORC-76-9) Avail: NTIS HC A02/MF A01 CSCL 12/1

A theory of multivariate life table analysis is developed. Estimators are developed for various multivariate interval failure rates. These estimators are multivariate extensions of the usual estimators in the univariate case. Under appropriate conditions, the estimators are shown to be asymptotically normal and asymptotically independent. GRA

N77-20848# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.

A METHOD FOR DETERMINING THE AUTOCOVARIANCE FUNCTION OF A BOX-JENKINS FORECASTING MODEL

Eginhard J. Muth Aug. 1976 34 p refs
(Grant DAHC04-75-G-0150; DA Proj. 200-61102-A-14D)
(AD-A032103; RR-76-20; ARO-12640.13-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

A method is presented for finding closed form expressions of the autocovariance function of a Box-Jenkins forecasting model. This method is based on the filter impulse response and its Z-transform, the transfer function. Several examples are worked out in detail; these and additional important cases are summarized in the Appendix. GRA

N77-20849# Wisconsin Univ., Madison. Mathematics Research Center.

SOME MATRIX OCCUPANCY PROBLEMS WITH DICHOTOMOUS ENTRIES

Lars Holst Aug. 1976 18 p refs
(Contract DAAG29-75-C-0024)
(AD-A031933; MRC-TSR-1663) Avail: NTIS HC A02/MF A01 CSCL 12/1

An R X N matrix is generated in the following way. In each row a predetermined number of positions are randomly assigned the value 1; the remaining positions are assigned the value 0. For each column a real valued function of the elements is given. In this paper the sum of the values of these functions is studied when N approaches the limit of infinity. The results can be applied to e.g. committee problems and contingency tables of 0-1-variables. Author (GRA)

N77-20850# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.

THE INVERTED COMPLEX WISHART DISTRIBUTION AND ITS APPLICATION TO SPECTRAL ESTIMATION

Paul Shaman Aug. 1976 21 p refs
(Contract N00014-76-C-0930; Grant NSF MPS-75-08286; NR Proj. 042-367)
(AD-A031118; ONR-6; TR-121) Avail: NTIS HC A02/MF A01 CSCL 20/6

The inverted complex Wishart distribution is studied and its use for the construction of spectral estimates is illustrated. The density, some marginals of the distribution, and the first- and second-order moments are given. For a vector-values time series, estimation of the spectral density at a collection of frequencies and estimation of the increments of the spectral distribution function in each of a set of frequency bands are considered. A formal procedure applies Bayes theorem, where the complex Wishart is used to represent the distribution of an average of adjacent periodogram values. A conjugate prior distribution for each parameter vector is a product of inverted complex Wishart distributions. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-20851# European Space Agency, Paris (France).

TECHNICAL/ECONOMICAL OPTIMISATION OF SPACE SYSTEMS BY THE DISTRIBUTION OF COMPLEXITY BETWEEN THE GROUND AND SPACE SEGMENTS

M. P. J. Fournet 1976 18 p ref Presented at the 7th IFAC Symp. on Autom. Control in Space, Rottach-Egern, West Ger., 17-21 May 1976
Avail: NTIS HC A02/MF A01

The optimum distribution of complexity between the various elements of a space system is discussed. Each system calls for a separate study. However, when one attempts to optimize the implementation of an overall, multidisciplinary strategy for space and to extend the scope of qualified technologies, such studies may introduce constraints resulting from the technical and economic interaction between the various programs. A quick study of the distribution of complexity between the ground and the spacecraft for the various current and future European programs show that every sort of arrangement is possible. For direct television broadcasting, complexity is maximum in the spacecraft and minimum on the individual user's premises. In certain earth resources projects, on-board data-compression will

be employed, in order to lighten the load on communication links and receiving stations. Other projects, such as the multidisciplinary earth observation satellite, may take the form of unmanned observatories, continuously controlled by observers on the ground. Other programs are also discussed: scientific, meteorological and telecommunications projects, as well as the very special case of Spacelab. Author (ESA)

N77-20852# European Space Operations Center, Darmstadt (West Germany).
INTERACTION SYSTEM FOR THE METEOROLOGICAL INFORMATION EXTRACTION CENTER IN THE METEOSAT PROJECT [IL SISTEMA INTERATTIVO NEL CENTRO ESTRAZIONE INFORMAZIONI METEOROLOGICHE DEL PROGETTO METEOSAT]
L. Fusco 1976 6 p In ITALIAN; ENGLISH summary Presented at the 16th Intern. Tech. Sci. Meeting on Space, Rome, 18-20 Mar. 1976
Avail: NTIS HC A02/MF A01

A description is given of the interactive system for the Meteorological Information Extraction Center in the Meteosat project. The purpose of the system is to improve the quality and the quantity of the automatically extracted meteorological products by means of human intervention. Basically the system consists of two NOVA 830 computers connected with the central computer, sharing three meteorological interactive consoles, each of them including alphanumeric, graphic, and image color displays. The system is designed to assist completely the meteorological operators during their operational and research work.
Author (ESA)

N77-20853# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
A MODEL OF A CLOSED-LOOP CONVEYOR WITH RANDOM MATERIAL FLOW
Eginhard J. Muth Sep. 1976 21 p refs
(Grant DAHC04-75-G-0150; DA Proj. 200-61102-A-14D)
(AD-A032102; RR-76-22; ARO-12640.14-M) Avail: NTIS HC A02/MF A01 CSCL 13/8

A closed-loop conveyor with one loading station and one unloading station is considered. The material arriving at the unloading station is modeled as a stationary stochastic process. An analytical solution for the probability distribution of the material flow leaving the unloading station is presented. It is shown that the storage feature of the closed loop can be used to smooth the random fluctuations present in the input flow. This smoothing is quantified by the variance reduction factor, which is the ratio of the variances of output flow and input flow. The variance reduction factor is related to the conveyor capacity and a linear decision rule for unloading. GRA

N77-20854# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
EFFICIENT POINTS IN LOCATION PROBLEMS
Richard E. Wendell, Arthur P. Hurter, Jr., and Timothy Lowe Jul. 1976 33 p refs
(Grants DAHC04-75-G-0150; NSF ENG-75-10225; DA Proj. 200-61102-A-14-D)
(AD-A032101; ARO.12640-11-M) Avail: NTIS HC A03/MF A01 CSCL 12/2

Much of the literature involving locating one or more new facilities in the plane is concerned with minimizing a single objective function. In this paper the authors consider the problem of generating the efficient set of locations for a single facility where it is important that the facility be located as close as possible to each of a number of existing facilities whose locations are known. They concentrate on the notion of distance commonly referred to as the (l sub 1) norm, the Manhattan norm, or the city-block norm but results for other norms are given also. They develop properties of the efficient set and present two separate procedures for generating the efficient set. GRA

N77-20855# Control Analysis Corp., Palo Alto, Calif.
AN INTRODUCTION TO THE REGENERATIVE METHOD FOR SIMULATION ANALYSIS
Micheal A. Crane and Austin J. Lemoine Oct. 1976 121 p refs
(Contract N00014-72-C-0086; NR Proj. 047-106)
(AD-A031593; TR-86-23) Avail: NTIS HC A06/MF A01 CSCL 12/2

The purpose of this report is to provide an introduction to the regenerative method for simulation analysis. The simulations are simulations of stochastic systems, i.e., systems with random elements. The regenerative approach leads to a statistical methodology for analyzing the output of those simulations which have the property of starting afresh probabilistically from time to time. The class of such simulations is very large and very important, including simulations of a broad variety of queues and queueing networks, inventory systems, inspection, maintenance, and repair operations, and numerous other situations. GRA

N77-20856# George Washington Univ., Washington, D.C. Program in Logistics.
ON APPROXIMATING AND BOUNDING GI/M/C QUEUES: A SUMMARY
Faiz A. Al-Khayyal and Donald Gross 30 Sep. 1976 36 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A032106; Serial-T-342) Avail: NTIS HC A03/MF A01 CSCL 12/2

Bounds and approximations for steady-state measures of effectiveness and state probabilities for GI/M/c queues are developed, requiring only the knowledge of the first two moments of GI. These are based on the ability to approximate and bound the single root, in (0,1), of the generating function equation associated with the GI/M/c queue. A method for obtaining this root for any GI, and the special cases GI = gamma and hyperexponential H sub 2 are discussed. The relation between the root and the coefficient of variation of the interarrival time distribution is investigated. Approximations to the root using GI = gamma (or H sub 2), where the first two moments of GI are matched to those of gamma (or H sub 2), are shown empirically to be good when the traffic intensity is at least moderate (greater than 0.5). Also included is an appendix containing an annotated bibliography of pertinent references.
Author

N77-20857# Naval Postgraduate School, Monterey, Calif.
SUPERIORITY OF FIT Final Technical Report
R. A. Weitzman Sep. 1976 14 p refs
(AD-A031337; NPS-54WZ76091) Avail: NTIS HC A02/MF A01 CSCL 12/2

In the context of both the Fisher and the Neyman-Pearson formulations, this article develops a method of testing superiority of fit to determine which of two different numerical predictions is more nearly accurate. Based on the assumption that the two predictions are not equally nearly accurate, the method is sequential continuing until a decision is reached in favor of one prediction or the other. The error probability of this decision is specifiable in advance of the test. GRA

N77-20858# Naval Postgraduate School, Monterey, Calif.
A PRACTICAL COMPUTATION METHOD FOR STEADY STATE SOLUTION OF M/E SUB k/c QUEUE M.S. Thesis
Mehmet Celayir Sep. 1976 57 p refs
(AD-A032370) Avail: NTIS HC A04/MF A01 CSCL 12/2

Numerical tables available for poisson arrivals and Erlang service time type queueing systems are discussed. A new approximation method for steady-state information and waiting time distribuiton of this queueing system was developed. Validity of approximation was established directly for the large waiting times and by simulation for the smaller values. The developed method enables one to find delay probability, expected number in the queue and in the system, expected time to be spent in the queue and in the system, and probability of waiting for more than a specified time t. GRA

N77-20859# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
REFINED PREDICTION FOR LINEAR REGRESSION MODELS Interim Report
J. L. Hess and R. F. Gunst Aug. 1976 22 p refs
(Grant AF-AFOSR-2871-75; AF Proj. 9769)
(AD-A031365; AFOSR-76-1125TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

Adequate prediction of a response variable using a multiple

linear regression model is shown in this article to be related to the presence of multicollinearities among the predictor variables. If strong multicollinearities are present in the data, this information can be used to determine when prediction is likely to be accurate. A region of prediction, R, is proposed as a guide for prediction purposes. This region is related to a prediction interval when the matrix of predictor variables is of full column rank, but it can also be used when the sample is undersized. The Gorman-Toman (1966) ten variable data are used to illustrate the effectiveness of the region R. Author (GRA)

N77-20860# Texas Univ., Austin. Center for Cybernetic Studies.

A NOTE ON THE BOUNDED INTERVAL GENERALIZED ASSIGNMENT PROBLEM

G. Terry Ross, Richard M. Soland, and Andris A. Zoltners Jul. 1976 15 p refs

(Contracts N00014-75-C-0616; N00014-75-C-0569; NR Proj. 047-021)

(AD-A031386; CCS-253) Avail: NTIS HC A02/MF A01 CSCL 12/2

The bounded interval generalized assignment problem is exemplified by the problem of assigning tasks to agents so that each task is assigned to exactly one agent and the time required to complete the set of tasks assigned to any one agent falls between prespecified lower and upper bounds. This note describes an efficient algorithm for solving this problem. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-20861# Wisconsin Univ., Madison. Mathematics Research Center.

BIFURCATION FOR ODD POTENTIAL OPERATORS AND AN ALTERNATIVE TOPOLOGICAL INDEX

Edward R. Fadell and Paul H. Rabinowitz Aug. 1976 35 p refs

(Contracts N00014-76-C-0300; DAAG29-75-C-0024; Grant NSF MCS-76-06373)

(AD-A031934; MRC-TSR-1661) Avail: NTIS HC A03/MF A01 CSCL 12/1

A bifurcation theorem is proved for odd potential operators. The operator equation is treated. A sharp description is given of the structure of a set of solutions near a bifurcation point as a function of lambda. A crucial role is played here by a notion of topological index alternative to other indices used in critical point theory and the properties of this index are developed in some detail. Author

N77-20862# Wisconsin Univ., Madison. Mathematics Research Center.

ISOPARAMETRIC AND SUBPARAMETRIC VARIATIONAL PROBLEMS Summary Report

Stephen D. Fisher Jul. 1976 44 p refs

(Contract DAAG29-75-C-0024; Grant NSF MPS-75-05501)

(AD-A031962; MRC-TSR-1650) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let T be an operator defined on the subset U of a Banach space X determined by equality or inequality constraints for a finite number of functionals on X. The necessary conditions that the solution of the minimization problem must satisfy is determined. A case of particular interest is when T has values in L(infinity). Several examples in detail are analyzed to show how the necessary conditions yield detailed information about the solution. The notion of a t-point is introduced and how the information becomes complete at such a point is shown. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-20863# Pennsylvania Univ., Philadelphia. Dept. of Mechanical Engineering and Applied Mechanics.

EFFECT OF ELECTRODE GEOMETRY ON THE TANH CONDUCTIVITY ARC MODEL Interim Report

Bejoy K. Choudhury and Ira M. Cohen Sep. 1976 48 p refs Submitted for publication Sponsored by Elec. Power Res. Inst.

(PB-259121/2; MEAM-76-6; EPRI-378-1/3) Avail: NTIS HC A03/MF A01 CSCL 20C

Conservation of energy for the temperature field is solved jointly with conservation of charge for the electrostatic potential for an arc in which the effects of convection and radiation are neglected. The electrical conductivity is modeled by a hyperbolic tangent function. Prolate spheroidal coordinates are used to emphasize the effects of electrode shape. Electrodes are chosen as hyperboloids of revolution (varying from needle-like to planar) and the bounding wall is a prolate spheroid. Approximate solutions are obtained by Galerkin's method. Current-voltage characteristics, arc shapes, and heat transfer to the electrodes and bounding wall are obtained. It was found that current-voltage characteristics are sensitive to electrode geometry and temperature. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-20864*# Vanderbilt Univ., Nashville, Tenn.

PULSE ANALYSIS OF ACOUSTIC EMISSION SIGNALS Ph.D. Thesis

J. Richard Houghton May 1976 182 p refs

(Grants NsG-8012; AF-AFOSR-2737-74)

(NASA-CR-152628) Avail: NTIS HC A09/MF A01 CSCL 20A

A method for the signature analysis of pulses in the frequency domain and the time domain is presented. Fourier spectrum, Fourier transfer function, shock spectrum and shock spectrum ratio are examined in the frequency domain analysis, and pulse shape deconvolution is developed for use in the time domain analysis. To demonstrate the relative sensitivity of each of the methods to small changes in the pulse shape, signatures of computer modeled systems with analytical pulses are presented. Optimization techniques are developed and used to indicate the best design parameters values for deconvolution of the pulse shape. Several experiments are presented that test the pulse signature analysis methods on different acoustic emission sources. These include acoustic emissions associated with: (1) crack propagation, (2) ball dropping on a plate, (3) spark discharge and (4) defective and good ball bearings. Author

N77-20865# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

ACOUSTIC EMISSION FROM COHERENT STRUCTURES IN A TURBULENT JET Ph.D. Thesis - Paris Univ.

Claude Dahan Dec. 1976 132 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-364)

(ONERA-P-1976-4; FR-ISSN-0078-379X) HC A07/MF A01

The measurement of turbulence properties aiming at the determination of the acoustic far field radiated by a hot free jet, in the subsonic range, was made with radiometers detecting the local infrared emission of the jet. These measurements, in good agreement with other results of the same kind obtained by other diagnostics, reveal the existence of large scale motions, the characteristics of which can be linked with the instability properties of the mixing zone of the jet. An experimental procedure based on the analysis of spectral relationships between the infrared signal fluctuations on one hand and the fluctuations of microphone signals picked up in the near and far pressure field on the other hand, was then elaborated and allows a proper identification of these coherent structures and an estimation of their acoustic efficiency. Author (ESA)

N77-20866# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

SOUND INVESTIGATION IN THE CHEMICAL CLEANING CENTRE OF THE JET ENGINE DEPARTMENT
A. M. Mimpen 1976 8 p In DUTCH; ENGLISH summary
(Contract A76/KL/041)
(IZF-1976-17; TDCK-68630) Avail: NTIS HC A02/MF A01

Following sound disturbance complaints, sound measurements at the Jet Engine Department of Woensdrecht Airport were made. It was shown that after mounting sound silencers in the airsucking installation in the chemical cleaning section the sound levels met the requirements. The sound reduction near the personnel of the bathes was from 13 to 15 dB(A), compared with the requirement of a reduction of at least 10 dB(A). A further reduction is not necessary because the sound level of the airsucking installation and the sound level of the background are nearly equal. The remaining sound level of about 70 dB(A) may be considered acceptable for the type of work carried out.
Author (ESA)

N77-20867*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF GEOMETRY AND JET VELOCITY ON NOISE ASSOCIATED WITH AN UPPER-SURFACE-BLOWING MODEL
Lorenzo R. Clark and James C. Yu (George Washington Univ.) Washington Mar. 1977 34 p refs
(NASA-TN-D-8386; L-11147) Avail: NTIS HC A03/MF A01 CSCL 20A

The noise characteristics associated with various upper surface blowing configurations were investigated using a small model consisting of a plate and flap assembly (simulated wing with flap) attached to a rectangular nozzle. Nozzle aspect ratio, flow-run length, and flap-deflection angle were the experimental parameters studied. Three nozzle-exit velocities were used. The normalized noise spectra obtained for different nozzle aspect ratios proved to be similar in terms of Strouhal number based on jet velocity and flow-run length. Consequently, the need for knowing local flow velocity and length scales (for example, at the flap trailing edge) as required in some of the existing noise prediction schemes is eliminated. Data are compared with results computed from three different noise prediction schemes, and the validity of each scheme is assessed. A simple method is proposed to evaluate the frequency dependence of acoustic shielding obtained with the simulated wing flap. Author

N77-20742# Ministry of Defence, London (England). Directorate of Civilian Medical Services.
NOISE LEVELS AND THEIR MEASUREMENTS AND INTERPRETATION IN THE VICINITY OF MILITARY AIRFIELDS
S. Kanagasabay *In* AGARD Special Aspects of Aviation Occupational and Environmental Medicine Feb. 1977 6 p refs
(For primary document see N77-20735 11-51)
Avail: NTIS HC A05/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-20868*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CORRELATION OF SELF-CONTAMINATION EXPERIMENTS IN ORBIT AND SCATTERING RETURN FLUX CALCULATIONS
John J. Scialdone Washington Mar. 1977 20 p refs
(NASA-TN-D-8438; G-7702) Avail: NTIS HC A02/MF A01 CSCL 20H

Gaseous emissions from a spacecraft modify the orbital environment degrade the observations of distant radiation sources, and provide contamination fluxes induced by self-scattering and scattering with ambient particles. Experiments were carried out on the orbiting Atmospheric Explorer-D satellite (AE-D) to verify the calculated return fluxes of a neon source. Known rates of neon were emitted in the direction of the velocity on command to the Molecular Return Measurement Unit (MRMU). At 250 km, the neutral mass spectrometer indicated a total neon return flux of .0246 times the emitted flux. The calculated fraction was .0123, including .00354 for the ambient scatter and .00354 for the altitude independent self-scatter. The pressure gages indicated return pressure less than .000933Pa .000007 at altitudes from 161 to 210 km. The maximum return pressure for 161-km orbit was calculated as 7.3 x 10-7 including a self scattering contribution of .000024 Pa .000000018. Author

N77-20869*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RELATIVISTIC ELECTROSTATIC SLATER INTEGRALS, 2 > OR EQUAL TO Z > OR EQUAL TO 106
Michio Aoyagi (Oregon Univ., Eugene), Mau Hsing Chen (Oregon Univ., Eugene), Bernd Crasemann (Oregon Univ., Eugene), Keh-Ning Huang (Oregon Univ., Eugene), and Hans Mark Washington Mar. 1977 352 p refs
(Grants NGR-003-036; DAHC04-75-G-0021)
(NASA-TR-R-464; A-6651) Avail: NTIS HC A16/MF A01 CSCL 20H

Two-electron electrostatic interaction integrals were computed with Dirac-Hartree-Fock-Slater wave functions. Results are listed for all orbitals in atoms with atomic numbers from Z = 2 through Z = 106. Author

N77-20870*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ATOMIC ELECTRON ENERGIES INCLUDING RELATIVISTIC EFFECTS AND QUANTUM ELECTRODYNAMIC CORRECTIONS
Michio Aoyagi, May Hsiung Chen (Oregon, Univ., Eugene), Bernd Crasemann (Oregon, Univ., Eugene), Keh-ning Huang (Oregon, Univ., Eugene), and Hans Mark Washington Mar. 1977 411 p refs
(NASA-TR-R-463; A-6637) Avail: NTIS HC A18/MF A01 CSCL 20H

Atomic electron energies have been calculated relativistically. Hartree-Fock-Slater wave functions served as zeroth-order eigenfunctions to compute the expectation of the total Hamiltonian. A first order correction to the local approximation was thus included. Quantum-electrodynamic corrections were made. For all orbitals in all atoms with 2 less than or equal to Z less than or equal to 106, the following quantities are listed: total energies, electron kinetic energies, electron-nucleus potential energies, electron-electron potential energies consisting of electrostatic and Breit interaction (magnetic and retardation) terms, and vacuum polarization energies. These results will serve for detailed comparison of calculations based on other approaches. The magnitude of quantum electrodynamic corrections is exhibited quantitatively for each state. Author

N77-20871# Brookhaven National Lab., Upton, N.Y.
HYPERFINE FIELDS AT IMPURITY SITES IN IRON
R. E. Watson and L. H. Bennett (NBS, Washington, D. C.) 1976 7 p refs Presented at Intern. Conf. on Magnetism, Amsterdam, 6 Sep. 1976
(Contract E(30-1)-16)
(BNL-21690; Conf-76092210) Avail: NTIS HC A02/MF A01

The correlation of hyperfine fields at impurity atom sites in ferromagnetic iron with atomic volume or with valence is considered. Using a scheme to normalize to the free atom hyperfine field, the correlations of volume, valence, and electronegativity with new normalized values are inspected. ERA

N77-20872# Ohio State Univ., Columbus.
NUCLEAR MAGNETIC RESONANCE INVESTIGATION OF ELECTRON DAMAGE IN Li-DOPED SILICON Final Report, 16 May 1974 - 15 Mar. 1976
L. Carlton Brown 6 Apr. 1976 112 p refs
(Contract F33615-74-C-2058)
(AD-A031057; OSURF-3909; AFAPL-TR-76-36) Avail: NTIS HC A06/MF A01 CSCL 20/8

This contract effort represents an experimental and analytical investigation of electron irradiation-damage and lithium-annealing processes in bulk n-type crucible-grown silicon samples. Objectives of the program were to obtain experimental data from nuclear magnetic resonance (NMR), electron paramagnetic resonance (EPR), and Hall effect measurements, and to correlate

these data with the assistance of appropriate accepted theories, all with the goal of increasing the knowledge of the radiation-damage and lithium-annealing processes. GRA

N77-20873# Stanford Research Inst., Menlo Park, Calif.
DETERMINATION OF THE BINDING ENERGY OF EXCITED RARE GAS DIMERS Final Report, 1 Jun. 1974 - 30 Jun. 1976
Keith T. Gillen 23 Aug. 1976 40 p refs
(Contract N00014-74-C-0307; NR Proj. 394-006; SRI Proj. PYU-3463)
(AD-A029458; SRI-MP-76-79) Avail: NTIS HC A03/MF A01 CSCL 07/4

Elastic scattering of angular distributions were measured for scattering of beams of argon, neon, and xenon by their respective ground state atoms at collision energies of the eV range. These scattering results were combined with other experimental and theoretical information to test and generate improved potential curves for the excited atom. Model calculations of elastic scattering were performed with the derived potential to evaluate the agreement with the experimental results. GRA

N77-20874# California Univ., Los Angeles. Dept. of Chemistry.
LUMINESCENCE AND INTERSYSTEM CROSSING PROCESSES IN CAMPHORQUINONE CRYSTALS
Phaedon Avouris, Alan Campion, and M. A. El-Sayed 30 Aug. 1976 26 p refs
(Contract N00014-75-C-0602; NR Proj. 056-498)
(AD-A030273; TR-24) Avail: NTIS HC A03/MF A01 CSCL 07/4

The use of phosphorescence microwave double resonance (PMDR) in detecting intersystem crossing (ISC) from higher excited singlet states is discussed. The method is then applied to camphorquinone for which such processes have been proposed to take place. The results of PMDR as well as other luminescence studies show no evidence to support such proposals. Theoretical aspects of the spin-orbit coupling interactions between n,pi* states in cis-alpha-diketones are analyzed. The results indicate that while nonplanarity allows direct spin-orbit coupling between n,pi* states of the same configuration, unlike in benzophenone, the one-center spin-orbit coupling terms vanish. Thus nonplanarity could only enhance spin-orbit coupling between n,pi* states of different configurations. These selection rules predict inefficient S2 to T2 and S1 to T1 ISC in CQ and account for the luminescence properties of this compound. GRA

N77-20875*# Arizona Univ., Tucson. Dept. of Physics.
EXPERIMENTAL LIMITS ON THE VELOCITIES OF SODIUM ATOMS SPUTTERED FROM SOLID SURFACES BY HYDROGEN IONS
John O. Stoner, Jr. 1976 5 p refs Sponsored in part by NASA and NSF
(Contract N00014-75-C-0499; NR Proj. 393-017)
(NASA-CR-149196; AD-A029947) Avail: NTIS HC A02/MF A01 CSCL 07/4

We have observed optical emission at LAMBDA 589.0 nm by sodium atoms sputtered from solid targets by hydrogen molecular ions. We saw no broadening or shifts of this line relative to that from a laboratory lamp, and can therefore put limits upon the speeds of sodium atoms ejected from surfaces in this way. Our results are consistent with the hypothesis that the atomic sodium cloud surrounding Io is produced by this mechanism. GRA

N77-20876# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
THE ROLE OF ELECTRON SPIN IN THE NF KINETIC SYSTEM Interim Report
John M. Herberlin 30 Jul. 1976 14 p refs
(Contract F04701-75-C-0076)
(AD-A029527; TR-0076(6240-40)-8; SAMSO-TR-76-155) Avail: NTIS HC A02/MF A01 CSCL 07/4

The reactions for the production and removal of the three lowest electronic states of nitrogen fluoride, NF(X triplet sigma), NF(a singlet delta), and NF(b singlet sigma -), are discussed from the standpoint of electron spin conservation. By invoking the Wigner-Witmer spin rule together with other spin-related properties, it is indicated that the electronically excited NF(a singlet delta) not only is the preferred product from the reaction of H, (D), and CH3 with NF2, but should also be less reactive toward other atoms, radicals, and itself than its ground-state counterpart NF(X triplet sigma). These conclusions are shown to be consistent with existing experimental results. Author (GRA)

N77-20877# Indiana Univ., Bloomington. Dept. of Chemistry.
A SELECTIVE SPECTRAL-LINE MODULATION TECHNIQUE FOR HIGH SENSITIVITY CONTIUUM SOURCE ATOMIC ABSORPTION SPECTROMETRY Interim Report
Ronald L. Cochran and Gary M. Hieftje 25 Aug. 1976 47 p refs
(Contract N00014-76-C-0838; Grant NSF CHE-76-10896; NR Proj. 051-622)
(AD-A029653; TR-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

A selective spectral-line modulation technique for performing continuum-source atomic absorption is described and its operation discussed. In the new technique, discrete droplets of a metal salt standard solution are periodically introduced into a source modulator flame. The atom clouds produced within this flame move through the radiation path of a continuum source, thereby selectively modulating only those atomic lines characteristic of the atoms within the cloud. This combination of continuum source and source modulator flame replaces a modulated line source within an otherwise typical atomic absorption spectrometer. The system is shown to enable multi-element analysis and exhibits relative freedom from both line and broad-band spectral interferences. Analytical curves and sensitivities obtained with the system for several elements are presented. Extensions of the system and its applications are briefly discussed.
Author (GRA)

N77-20878# Illinois Univ., Urbana-Champaign. Dept. of Chemistry.
ENERGY DISTRIBUTIONS IN MOLECULES
R. A. Marcus Oct. 1976 35 p refs
(Contract N00014-75-C-0942)
(AD-A031708; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/4

The paper describes results on modes of anharmonically coupled oscillators in a molecule, the role of energy exchange and near-degeneracy, and quasi-periodic versus ergodic theory of unimolecular reactions. The quasi-periodic one is a formal generalization of Slater's harmonic oscillator theory. Spectral decomposition of a classical trajectory for the molecule provides insight into the molecular spectrum, both in the low (quasi-periodic) and high (ergodic) energy regimes. The role of quantization of transition states in unimolecular reactions and a relation to vibrational adiabaticity are analyzed. Results obtained on energy distribution of translational energy of molecular beam reactions involving intermediate complexes and tight exit channel transition states are described together with the relation to intramolecular energy randomization. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N77-20879# Fusion Systems Corp., Rockville, Md.
ENHANCED ENERGY UTILIZATION FROM A CONTROLLED THERMONUCLEAR FUSION REACTOR Final Report
F. R. Scott Sep. 1976 112 p refs Sponsored by Elec. Power Res. Inst.
(PB-260653/1; EPRI-ER-248) Avail: NTIS HC A06/MF A01 CSCL 18A

Applications of fusion energy to synthetic fuel production, chemical manufacturing, and materials processing were investigated. Computer codes were developed to permit quantitative calculation of the enhancement of energy utilization efficiency for multipurpose Tokamak and mirror reactors. Production of

synthetic portable fuels such as hydrogen or methane by neutron radiolysis is identified as the most important near term application. Fuel production offers large advantages for low Q, high circulating power systems such as mirrors, small Tokamaks, theta pinches, and laser pellet reactors. It offers little advantage to high Q, high thermal efficiency systems typified by large Tokamaks. GRA

N77-20880# Brueckner (K. A.) and Associates, Inc., La Jolla, Calif.
ASSESSMENT OF LASER-DRIVEN FUSION Final Report
F. R. Scott Sep. 1976 162 p refs Sponsored by Elec. Power Res. Inst.
(PB-260691/1; EPRI-ER-203) Avail: NTIS HC A08/MF A01 CSCL 18A

The national fusion program as of March 1976 is described. Included are summaries by the Laser Fusion Advisory Committee and the Working Group. Scientific and technical evaluations of the national laser fusion program are presented in four parts: an overall assessment, engineering feasibility, scientific feasibility, and site visits. GRA

N77-20881# Naval Research Lab., Washington, D.C.
THE STATUS OF THE NONLINEAR THEORY OF DRIFT AND TRAPPED PARTICLE INSTABILITIES
Wallace M. Manheimer Sep. 1976 12 p
(Contract E(49-20)-1006; NRL Proj. H02-37)
(AD-A031491; NRL-MR-3369) Avail: NTIS HC A02/MF A01 CSCL 20/9

This note is a short appraisal of the status of nonlinear theories for drift waves and trapped particle instabilities as seen by the author. Such instabilities are thought to play a crucial role in the energy confinement capability of Tokamaks. Some of the phenomenological and strong turbulence theories are discussed followed by a discussion of the more quantitative weak turbulence theories. GRA

74 OPTICS

Includes light phenomena.

N77-20882* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BINOCULAR DEVICE FOR DISPLAYING NUMERICAL INFORMATION IN FIELD OF VIEW Patent
Harry V. Fuller, inventor (to NASA) Issued 15 Mar. 1977 6 p Filed 28 Aug. 1975 Supersedes N75-30516 (13 - 21, p 2672)
(NASA-Case-LAR-11782-1; US-Patent-4,012,123; US-Patent-Appl-SN-608482; US-Patent-Class-350-174; US-Patent-Class-350-145) Avail: US Patent Office CSCL 20F

An apparatus is described for superimposing numerical information on the field of view of binoculars. The invention has application in the flying of radio-controlled model airplanes. Information such as airspeed and angle of attack are sensed on a model airplane and transmitted back to earth where this information is changed into numerical form. Optical means are attached to the binoculars that a pilot is using to track the model air plane for displaying the numerical information in the field of view of the binoculars. The device includes means for focusing the numerical information at infinity whereby the user of the binoculars can see both the field of view and the numerical information without refocusing his eyes.
Official Gazette of the U.S. Patent Office

N77-20883# Sandia Labs., Albuquerque, N.Mex. Optics Div.
OPTO-MECHANICAL SCANNING TECHNIQUE FOR PATTERN RECOGNITION
Eugene A. Igel and Garth W. Gobeli Jan. 1976 31 p refs
(Contract AT(29-1)-789)
(SAND-75-0660) Avail: NTIS HC A03/MF A01

An opto-mechanical scanning technique and initial experiments are described in which characteristics of undirectional resolution produced by one-dimensional imaging is used both for detection and geometric classification of linear arrays. Classification is achieved by angular identification of linear arrays. ERA

N77-20884# Bendix Corp., Kansas City, Mo.
PROGRESS IN AUTOMATIC IMAGE MEASUREMENT
J. R. Lembke Aug. 1976 21 p refs
(Contract E(29-1)-613)
(BDX-613-1401-Rev) Avail: NTIS HC A02/MF A01

A self-calibration capability was added to the Automatic Image Measurement System (AIMS). The strategy for edge threshold selection was optimized. A horizontal optical mount was designed and built, incorporating stepper-motor control of focus and image rotation. The system was mounted on a manual positioner for inspection of features on nonplanar surfaces. Plans were developed for application of AIMS to an automatic point-location gaging system. A capability study was performed to determine repeatability of AIMS. ERA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-20885*# Texas Univ., Dallas.
CARBON DIOXIDE AS WORKING GAS FOR LABORATORY PLASMAS
R. Kist (Inst. fuer Physikalische Weltraum Forschung, Freiburg) Paris ESA Sep. 1976 24 p
(Grant NGR-44-004-30)
(NASA-CR-149893; ESA-SN-124) Avail: NTIS HC A02/MF A01

Measurements with a RF probe, retarding potential analyzer and mass spectrometer in a laboratory plasma tank were performed using the gases CO2, N2, A and He in order to compare their properties as working gases for laboratory plasma production. The overall result of that CO2 leads to higher plasma densities at lower neutral-gas pressures as well as to a larger Maxwellian component of the electron population, while the electron temperature is lower than that when N2, A and He are used.
Author

N77-20886*# Magnetic Corp. of America, Waltham, Mass. Technical Report, Sep. 1975 - Dec. 1976
DESIGN STUDY OF SUPERCONDUCTING MAGNETS FOR A COMBUSTION MAGNETOHYDRODYNAMIC (MHD) GENERATOR
Richard J. Thome and John W. Ayers Mar. 1977 255 p refs
(Contract NAS3-19885)
(NASA-CR-135178) Avail: NTIS HC A12/MF A01 CSCL 20I

Design trade off studies for 13 different superconducting magnet systems were carried out. Based on these results, preliminary design characteristics were prepared for several superconducting magnet systems suitable for use with a combustion driven MHD generator. Each magnet generates a field level of 8 T in a volume 1.524 m (60 in.) long with a cross section 0.254 m x 0.254 m (10 in. x 10 in.) at the inlet and 0.406 m x .406 m (16 in. x 16 in.) at the outlet. The first design involves a racetrack coil geometry intended for operation at 4.2 K; the second design uses a racetrack geometry at 2.0 K; and the third design utilizes a rectangular saddle geometry at 4.2 K. Each case was oriented differently in terms of MHD channel axis and main field direction relative to gravity in order to evaluate fabrication ease. All cases were designed such that the system could be disassembled to allow for alteration of field gradient in the MHD channel by changing the angle between coils. Preliminary design characteristics and assembly drawings were generated for each case. Author

N77-20887# Princeton Univ., N.J. Plasma Physics Lab.
ELECTROSTATIC ION CYCLOTRON INSTABILITIES DRIVEN BY PARALLEL ION BEAM INJECTION
M. Yamada, S. Seiler, H. W. Hendel, and H. Ikezi Jul. 1976 36 p refs
(Contract E(11-1)-3073)
(MATT-1254) Avail: NTIS HC A03/MF A01

The detailed identification is presented for two instabilities driven by an ion beam injected parallel to the confining magnetic field, a resonant ion cyclotron instability and a nonresonant ion cyclotron drift wave driven by the beam's density gradient. Experimental results are in good agreement with numerical calculations based on the kinetic Vlasov equations. Quasi-linear velocity space diffusion of the beam ions by wave-particle interaction is observed, demonstrating enhenced energy transfer. The relevance of these results to Tokamak neutral beam injection heating is discussed. ERA

N77-20888# Princeton Univ., N.J. Plasma Physics Lab.
SOME NONLINEAR EFFECTS IN TEARING MODE INSTABILITY
P. Kaw Jun. 1976 18 p refs
(Contract E(11-1)-3073)
(MATT-1264; Conf-760635-5) Avail: NTIS HC A02/MF A01

Two nonlinear effects which may be of relevance in the development of tearing mode instability are discussed: the effect of a given background turbulence of drift waves on the growth of tearing modes; and the effect of a plasma flow towards the X points on nonlinear growth of tearing modes. The possible relevance of the latter process to disruptive instability in Tokamaks is also discussed. ERA

N77-20889# Oak Ridge National Lab., Tenn. Thermonuclear Div.
GLOBAL PROPERTIES OF HIGH PRESSURE FLUX CONSERVING TOKAMAK EQUILIBRIA
J. F. Clarke and D. J. Sigmar (MIT) Aug. 1976 24 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5599) Avail: NTIS HC A02/MF A01

An approximate analytic theory is developed to calculate the poloidal beta beta/sub I/ and the diamagnetic parameter mu/sub I/ for a sequence of axisymmetric toroidal MHD equilibria confining high pressure plasma [beta approximately theta(a/R)] under the constraint of flux conservation. To satisfy the equilibrium equations, the plasma current must be increased with pressure as p/sub 1/3/and previously calculated equilibrium limits on poloidal beta are avoided. ERA

N77-20890# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
STUDY OF FAST MAGNETOSONIC WAVE AND NEUTRAL BEAM HEATING OF LARGE TOKAMAKS
N. A. Amherd, Robert W. Conn, and Gerald L. Kulinski Sep. 1976 73 p refs
(PB-260555/8; EPRI-ER-268) Avail: NTIS HC A04/MF A01 CSCL 18A

The leading wave heating candidates include low frequency Alfven waves, fast magnetosonic waves, lower hybrid waves, and electron cyclotron waves and these are briefly surveyed. A more detailed consideration is given to the fast magnetosonic wave and its use in heating a tokamak reactor to ignition. A conceptual magnetosonic wave launching system compatible with reactor plasmas is also described. The status of neutral beam heating, the requirements on injection energies, and the resulting heating profiles for reactor plasmas are described. Finally, a comparison of RF (radiofrequency) and neutral beam heating is presented. GRA

N77-20891# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
NONLINEAR HEATING OF PLASMAS BY HIGH POWER LASERS Final Report, Aug. 1972 - Jul. 1976
Martin V. Goldman 31 Jul. 1976 19 p
(Contract F44620-73-C-0003; AF Proj. 9751)
(AD-A031287; CU-1019; AFOSR-TR-76-1116-ATTACH-1)
Avail: NTIS HC A02/MF A01 CSCL 20/9

This report covers research on Nonlinear Heating of Plasmas by High Power Lasers. The overall objective of the program was to study the interaction of intense laser radiation with high density plasma, such as that produced by radiation impinging on a cold target or from a pre-existing plasma. GRA

N77-20892# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
Co2-EXCITED LANGMUIR TURBULENCE IN A DENSE PLASMA FOCUS Final Report
M. J. Forrest, P. D. Morgan, N. J. Peacock, K. Kuriki, and M. V. Goldman 31 Jul. 1976 17 p refs
(Contract F44620-73-C-0003; AF Proj. 9751)
(AD-A031289; CU-1019-A2; AFOSR-TR-76-1116-ATTACH-2)
Avail: NTIS HC A02/MF A01 CSCL 20/9

A report is made on ruby-laser scattering measurements of Langmuir turbulence excited in a high-density plasma by a CO2 laser pump. The observations can be explained by a new treatment of the convective electron-ion decay instability at equal temperatures. GRA

N77-20893# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
LANGMUIR SHOCK WAVES Final Report
Martin V. Goldman and Dwight R. Nicholson 31 Jul. 1976 22 p refs
(Contract F44620-73-C-0003; AF Proj. 9751)
(AD-A031290; CU-1019-A3; AFOSR-TR-76-1116-ATTACH-3)
Avail: NTIS HC A02/MF A01 CSCL 20/9

Intense Langmuir waves in a uniform, one-dimensional plasma are described by a nonlinear Schroedinger equation. When the effect of linear Landau damping is included, we find steady state shock wave solutions. For an infinite plasma, frequency determines shock amplitude and (subsonic) speed. For a semi-infinite plasma, the shock is stationary; its frequency determines its amplitude, and the energy flux through the boundary determines the spatial extent of the field. Author (GRA)

N77-20894# Naval Research Lab., Washington, D.C. Plasma Dynamics Branch.
STARK PROFILE CALCULATIONS FOR THE LINES OF THE A1 XIII LYMAN SERIES EMITTED IN DENSE PLASMA
Paul C. Keppie and Hans R. Griem (Maryland Univ., College Park) Oct. 1976 23 p refs
(AD-A032025; NRL-MR-3382) Avail: NTIS HC A02/MF A01 CSCL 07/4

The Stark broadened profiles of the first six members of the Lyman series of A1 XIII, emitted in dense plasmas, are calculated. It is assumed that Stark broadening due to thermal fluctuations of the electric microfield dominates all other line broadening mechanisms. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N77-20895# California Univ., Los Angeles. Dept. of Chemistry.
ELECTRIC FIELD EFFECT ON THE SPIN ALIGNMENT OF TRIPLET TRAPS OF 4, 4 PRIME-DICHLOROBENZOPHENONE CRYSTAL
S. J. Sheng (Notre Dame Univ., Ind.) and M. A. El-Sayed 1 Sep. 1976 21 p refs
(Contract N00014-75-C-0602; NR Proj. 056-498)
(AD-A029922; TR-25; Contrib-3685) Avail: NTIS HC A02/MF A01 CSCL 07/4

The spin alignment of triplet traps of the polar 4,4 prime-dichlorobenzophenone neat crystal is changed by applying an external electric field which results in a change of the phosphorescence intensity and phosphorescence microwave double resonance (PMDR) signals. This and the results of other experiments can best be explained if one assumes that the field modifies the triplet - rather than singlet - exciton dynamics. A possible field-induced change in the radiative properties of the spin levels of the shallow traps (13-17 per cm) is also observed. Author (GRA)

N77-20896# Argonne National Lab., Ill.
MOVEMENT OF DISLOCATIONS THROUGH A RANDOM ARRAY OF WEAK OBSTACLES OF FINITE WIDTH
R. Labusch and R. B. Schwarz 1976 10 p refs Presented at Conf. on Computer Simulation for Mater. Appl., Gaithersburg, Md., 19-21 Apr. 1976

(Contract W-31-109-eng-38)
(CONF-760421-7) Avail: NTIS HC A02/MF A01

The movement of a dislocation through a random array of weak obstacles of finite width was simulated with the aid of a digital computer. Through a normalization of the equation of motion it is shown that in the absence of inertial effects the flow stress is a function of a single parameter eta(0) = (ŷ(0)/1/sub s/) square root (2 Gamma/F/sub y/), where Y(0) is the range of the dislocation obstacle interaction force in the direction perpendicular to the dislocation, 1/sub s/ is the average distance between obstacles, F/sub y/ is the strength of the interaction force, and Gamma is the dislocation line tension. The calculations suggest a relation of the form sigma = A (1 + eta(0)B)/sup 1/3/ for the flow stress, where A and B are constants. ERA

N77-20897# Sandia Labs., Albuquerque, N.Mex.
ELECTRICAL CONDUCTIVITY OF MEMORY-TYPE CdGeAs2 SEMICONDUCTING GLASSES
R. T. Johnson, Jr. and Rod K. Quinn Aug. 1976 17 p refs
(Contract E(29-1)-789)
(SAND-76-0359) Avail: NTIS HC A02/MF A01

Electrical conductivity changes associated with the thermally induced amorphous-to-crystalline transformation in CdGeAs2 semiconducting glasses were examined. Results from these experiments, in conjunction with other materials considerations, suggest that the II-IV-V compound semiconducting glasses may be good memory-type materials in comparison to the chalcogenide glasses. ERA

N77-20898# Argonne National Lab., Ill.
PHOTOEXCITATION IN SUPERCONDUCTORS Ph.D. Thesis Nortwestern Univ.
Ivan Schuller Jun. 1976 142 p refs
(Contract W-31-109-eng-38)
(ANL-76-XX-8) Avail: NTIS HC A07/MF A01

A measurement was made for the first time of the relaxation time of the superconducting order parameter and the equilibrium energy gap close to T/sub c/. The results indicate that the relaxation time of the magnitude of the order parameter diverges as 1/delta /sub eq/for T/T/sub c/greater than or equal to 0.99, in agreement with theory. The inelastic collision time for electrons determined from this experiment is consistent with surface-Landau-level-resonance experiments and theory. ERA

N77-20899# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
PREPARATION AND PROPERTIES OF THIN FILM GaxIn(1-X)As AND GaAsxSb(1-X) ALLOY FILMS Final Report, 1 Dec. 1973 - 15 Nov. 1974
James M. Whelan 10 Jul. 1976 33 p refs
(ARPA Order 2182)
(AD-A031086) Avail: NTIS HC A03/MF A01 CSCL 20/12

Epitaxial alloy films were grown from solutions using three versions of the growth reactor. An effort was made to closely monitor the reducing quality of the H2 atmosphere in the reactor. Failure to grow suitably thin films is attributed to the inadequate quality of this atmosphere. Author (GRA)

N77-20900# Wayne State Univ., Detroit, Mich. Coll. of Engineering.
MECHANISM OF EXOELECTRON EMISSION FROM SOLID SURFACES Final Report, 1 Jul. 1973 - 30 Apr. 1976
L. Himmel and Peter F. Braeunlich May 1976 18 p refs
(Grant AF-AFOSR-2573-74; AF Proj. 9761)
(AD-A029551; AFOSR-76-0994TR) Avail: NTIS HC A02/MF A01 CSCL 20/3

Using sensitive single-particle and single-photon detectors, combined with magnetic discrimination techniques, it is shown that electrons, positive and negative ions, and photons are all emitted simultaneously when rupture of the superficial oxide film occurs during tensile deformation of oxide-covered metals. With compact adherent, anodically-grown Al2O3 films on Al and dense thermally-grown NiO films on Ni, the major fraction of the emitted particles are low energy electrons. Particle emission is believed to originate from crack surfaces in the oxide film. The dependence of the electron emission yield on oxide thickness has been established for dense anodic oxide films up to 2,000 A thick on Al. It is also found that the total or integrated yield for 2,000 A thick oxide films decreases in the order Al to Ni to Ti. The tribostimulated electrons exhibit a rather broad energy spectrum which is definitely non-Maxwellian. The emission behavior is also found to depend strongly on the conditions under which anodic oxide films are grown. It is tentatively suggested that the emission observed from dense oxide films may be primarily of thermionic origin, the needed excitation energy being provided by the elastic strain energy stored in the oxide film that is released during fracture of the film. Author (GRA)

N77-20901# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
INVESTIGATION OF DEFECTS AND IMPURITIES IN SILICON-ON-SAPPHIRE Interim Technical Report, 15 Jul. 1975 - 31 Jan. 1976
John L. Peel and Michael D. Barry Griffiss AFB, N. Y. RADC Jul. 1976 53 p refs
(Contract F19628-75-C-0108; AF Proj. 672A)
(AD-A030777; C76-142/501; RADC-TR-76-208; SR-2) Avail: NTIS HC A04/MF A01 CSCL 11/2

This report covers the second six months of a program to investigate the effects of defects and impurities in SOS materials on the electrical characteristics and radiation tolerance of CMOS/SOS devices. Additional chemical surface-etch experiments and IMMA analyses were completed during this phase of the program. This phase of the study focused on fabricating CMOS/SOS devices on the various substrate groupings examined in the first phase of this study. Electrical parameter data and radiation hardness data were obtained for the CMOS/SOS devices and correlated with SOS material characteristics. Author (GRA)

N77-20902# RCA Labs., Princeton, N.J.
RADIATION AND CHARGE INJECTION IN Al2O3 USING NEW TECHNIQUES Final Report, 18 Dec. 1974 - 16 Dec. 1975
Richard J. Powell 16 Jan. 1976 60 p refs
(Contract F19628-74-C-0132)
(AD-A031424; PRRL-76-CR-8; AFGL-TR-76-0017) Avail: NTIS HC A04/MF A01 CSCL 20/12

Optical transmission of unbacked thin films of thermally grown SiO2 films was measured in the vacuum UV. The absorption data indicate a bandgap of 8.0 + or - 0.2 eV for SiO2, and this value is confirmed by measurements of electron and hole photoconductivity and positive charging thresholds in MOS samples. Coincidence of the absorption and hole photoconductivity thresholds provides evidence that the uppermost valence levels in SiO2 form a band, perhaps quite narrow, and most likely are dominated by oxygen 2 ppi and silicon 3d atomic orbitals. Vacuum ultraviolet radiation studies of steam-grown SiO2 samples with different annealing temperatures show a rather sharp minimum in hole trapping at 1000 C. The results indicate the presence of at least two trap species whose densities vary oppositely with anneal temperature. A reasonable fit to the experimental results is obtained using a two-trap model, with trap cross sections of 1.04 x 10 to the -13th power sq cm and 6.5 x 10 to the -15th power sq cm. The former is believed to be associated with a species that diffuses into the oxide, particularly at high anneal temperatures, and the latter is associated with intrinsic interface trapping. Corona discharge experiments are inconsistent with the VUV results in that a montonic increase in hole trap density with anneal temperature is observed. This is tentatively explained by the possible inability of this technique to fill traps with certain energy levels and spatial locations. Included in this report is a summary of previous work on Al2O3 which is described in earlier technical reports issued under this contract.
Author (GRA)

N77-20903# Naval Research Lab., Washington, D.C. Electronics Technology Div.
CHARACTERIZATION OF III-V MATERIALS Annual Summary Report, 1 Jul. 1975 - 30 Jun. 1976
Bruce D. McCombe Oct. 1976 76 p refs
(NRL Proj. P01-14C)
(AD-A032284; NRL-MR-3357) Avail: NTIS HC A05/MF A01 CSCL 20/12

The program includes electrical, chemical, structural and topographic characterization as well as device fabrication and evaluation, and is carried out on a coordinated basis by three

Navy laboratories: The Naval Research Laboratory, the Naval Surface Weapons Center and the Naval Electronics Laboratory Center. The primary goals of the effort continue to be: (1) to provide rapid and interactive feedback of routine characterization information to the materials growth effort, and (2) to develop new, innovative methods for material characterization. Characterization techniques described include routine Hall effect measurements, photoconductivity, contactless microwave magnetoconductivity, contactless infrared optical measurements of carrier density and mobility, scanning electron microscopy, soft X-ray appearance potential spectroscopy, photoluminescence of bulk and interface states, and fabrication and test of Schottky barrier field effect transistors. Results achieved with these techniques on GaAs and InP materials produced in-house and provided by commercial laboratories are described. GRA

N77-20904# Indian Inst. of Tech., Kanpur.
PROPERTIES OF IONIC SOLIDS Interim Technical Report, 1 May 1971 - 30 Apr. 1975
E. C. Subbarao Apr. 1976 20 p refs
(Grant AF-AFOSR-2136-71; AF Proj. 7021; AF Proj. 6813)
(AD-A031528; AFML-TR-76-36) Avail: NTIS HC A02/MF A01 CSCL 20/12

This report detailed the preparation of 'pure' and doped ionic solids, characterization of the defect structure, and the correlation of electrical transport properties with the defect structure. The three materials systems investigated were zirconia-base, thoria-base, and beta alumina. The zirconia monoclinic-tetragonal transformation was characterized as martensitic, and a revised phase diagram for the system ZrO2 - YO(1.5) system was proposed. In the thoria-base system, electrical conductivity measurements in air indicated that isothermal conductivity increased with CaO content and reached a broad maximum. The electrical conductivity of sodium doped beta and beta double prime Al2O3 was found to be a function of sodium content, frequency, temperature and type of electrode employed. GRA

N77-20905# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
GALLIUM DIFFUSION IN SILICON DIOXIDE. RUTHERFORD BACKSCATTERING ANALYSIS OF THIN FILMS Final Report, 1 Sep. 1973 - 28 Aug. 1974
Patrick M. Hemenger May 1976 101 p refs
(AD-A031740; AFML-TR-75-55) Avail: NTIS HC A06/MF A01 CSCL 07/2

The behavior of Ga in sputtered SiO2 films is examined with the result that diffusion is observed during annealing at 850 C. The accumulated evidence indicates that SiO2 is not an effective film to use on a GaP or GaAs for protection against Ga loss during high temperature anneals. The method employed to make the measurements, Rutherford backscattering (RBS) analysis of SiO2:Ga:SiO2 sandwiches, is demonstrated to be effective and applicable to other systems. The value of RBS as a general tool for thin film analysis is demonstrated by measuring the thicknesses and compositions of several types of films as well as the concentrations and locations of impurities.
Author (GRA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-20906*# Maryland Univ., College Park. Inst. for Physical Science and Technology.
THE THERMAL CONDUCTIVITY OF STEAM IN THE ZERO DENSITY LIMIT AS A FUNCTION OF TEMPERATURE Interim Report
J. V. Sengers and R. S. Basu Apr. 1977 18 p refs Proposed for presentation at the Meeting of the Special Thermal Conductivity Task Group of the Intern. Assoc. for the Properties of Steam, Providence, May 1977
(Grant NGR-21-002-344)
(NASA-CR-152619; BN-852) Avail: NTIS HC A02/MF A01

An equation for the thermal conductivity of steam at pressures of 1 atmosphere and below is presented. Sources of the experimental data and the actual data used in the analysis are presented. Also included is low density data below 100 C.
Author

N77-20907# Energy Research and Development Administration, Bartlesville, Okla.
THERMODYNAMIC PROPERTIES OF ORGANIC COMPOUNDS AND THERMODYNAMIC PROPERTIES OF FLUIDS Final Technical Summary Report, 1 Jul. 1975 - 30 Jun. 1976
Donald R. Douslin, Donald W. Scott, William D. Good, and Ann G. Osborn 1976 21 p refs
(AF Proj. 9750)
(AD-A031013; AFOSR-76-1075TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

The search for molecular hydrocarbon structures that contain higher energies than usual hydrocarbon jet fuel liquids was centered on compounds that contain strained bridging bonds between ring systems. Enthalpies of combustion and formation, vapor pressures, enthalpies of sublimation and vaporization, and chemical thermodynamic properties were determined.
Author (GRA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-20908# Scientific Control Systems Ltd., London (England).
APPLICATION OF SUITABLE TECHNIQUES TO PROBLEMS OF OPTIMAL SCHEDULING, VOLUME 1
D. Zachary, J. Poston, S. Storey, S. Sassoon, and N. Soaman Nov. 1976 76 p 3 Vol.
(Contract ESOC-TA/154/75-AR)
(ESA-CR(P)-893-Vol-1) Avail: NTIS HC A05/MF A01

A simple basic computer configuration in a ground support system was studied with a view to optimizing scheduling. Operational problems likely to occur on this system were examined and where possible related to the design of the system. Some of the operational difficulties that will arrise are highlighted, and methods of solution for a more complex network configuration are extrapolated. Ground system parameters of interest are identified and illustrated by the ESOC program for Meteosat. Operational problems that will exist are identified, and a proposal is made for the development of solution methods. ESA

N77-20909# Scientific Control Systems Ltd., London (England).
APPLICATION OF SUITABLE TECHNIQUES TO PROBLEMS OF OPTIMAL SCHEDULING, VOLUME 2
D. Zachary, J. Poston, S. Storey, S. Sassoon, and N. Seaman Nov. 1976 68 p 3 Vol.
(Contract ESOC-TA/154/75-AR)
(ESA-CR(P)-893-Vol-2) Avail: NTIS HC A04/MF A01

Possible techniques for solving the problems of satellite ground computer systems optimal scheduling were developed. Mathematical programming is discussed as the most useful family of optimization techniques. Various formulations directly dependent on the mode of operations are proposed, and, for each, the most likely application possibilities are indicated. For unsolvable cases such as representation in a closed functional form of some

of the relationships of the ground system, simulation techniques are discussed. Several useful techniques are identified which can be applied in both the transition stages of ground system operations, in planning for expected contingencies, and in the analysis that will accompany the experimental phase of a satellite system. ESA

N77-20910# Scientific Control Systems Ltd., London (England).
APPLICATION OF SUITABLE TECHNIQUES TO PROBLEMS OF OPTIMAL SCHEDULING, VOLUME 3
D. Zachary, J. Poston, S. Storey, S. Sassoon, and N. Seaman Nov. 1976 42 p refs 3 Vol.
(Contract ESOC-TA/154/75-AR)
(ESA-CR(P)-893-Vol-3) Avail: NTIS HC A03/MF A01

Two further phases of the optimal scheduling of ESOC ground support systems are discussed. The implementation of the scheduling system and the development costs of the application programs as well as the scheduling software are outlined. Likely development phases the various application programs will go through are identified. A literature evaluation is also presented. ESA

N77-20911# American Univ., Washington, D.C. Coll. of Public Affairs.
PUBLIC MANAGEMENT OF SCIENCE: CASE STUDIES
1 Oct. 1976 582 p refs
(PB-258945/5) Avail: NTIS HC A25/MF A01 CSCL 05A

In a graduate course on the Public Management of Science each student undertook to prepare a descriptive monograph on the management of science in a Federal agency. To provide a self-learning experience and a useful exchange of findings within the class data gathered will provide a better base of documentation for students in subsequent offerings of the course. GRA

N77-20912# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A COMPARISON OF SELECTED SCHEDULING HEURISTICS FOR A TAC F-4E MAINTENANCE ORGANIZATION M.S. Thesis
Richard F. Glad and Robert T. Pierce Sep. 1976 87 p refs
(AD-A032327; SLSR-23-76B) Avail: NTIS HC A05/MF A01 CSCL 15/5

Scheduling of activities in simple and complex environments has been a subject of active research for many years. The USAF has actively supported such research in its continuing efforts to determine the impact of scheduling effectiveness on mission capability. The recent validation and availability of the Logistics Composite Model (L-COM) made it possible to test selected scheduling heuristics in the dynamic maintenance environment of a TAC F-4E squadron. Five heuristics were formulated, inserted into the model, and allowed to operate during simulation. Results of the simulation indicated that the selected heuristics did impact mission capability, that rank ordering occurred between them, and that there was a statistically significant difference between the worst and the best heuristic (88.15% to 91.57% sortie effectiveness). GRA

N77-20913# Army Construction Engineering Research Lab., Champaign, Ill.
A PRELIMINARY CONCEPT FOR A DESIGN CRITERIA MANAGEMENT SYSTEM
Michael J. OConnor and David A. Jordani Sep. 1976 89 p refs
(AD-A032125; ERL-SR-P-74) Avail: NTIS HC A05/MF A01 CSCL 13/13

The Corps of Engineers' design process relies on the relevancy and currentness of the data used in facility design and the transfer of these data to and from a variety of design and review levels. This report presents a conceptual description of an effective system for the organization, management, and communication of Department of Defense and Corps of Engineers military construction design criteria. The conceptual system comprises three major subsystems: (1) the Standard Design Criteria Subsystem provides for the handling, consistency checking, and production of standard design criteria; (2) the Project-Specific Design Criteria Subsystem permits the introduction of project-specific criteria and the merging of them with standard criteria; and (3) the Facility Criteria File Generation Subsystem translates the criteria into an appropriate format and relates the criteria to the design procedures. Author (GRA)

N77-20914# Picatinny Arsenal, Dover, N.J. Management Information Systems Directorate.
GRAFTEK - GRAFFIT CURVE FITTING PROGRAM TEKTRONIX VERSION Final Report
Wayne D. Lunger Sep. 1976 138 p
(AD-A031854; MISD-UM-76-3) Avail: NTIS HC A07/MF A01 CSCL 09/2

GRAFTEK is an interactive graphics program that fits by least squares, a curve to N data points. This code combines two CDC 274 graphics curve fitting programs (GRAFFIT, LSQ) for use on the TEKtronix 4014 storage tube using Tektronix software (TCS). The program fits the curve and determines the constants for any of nine empirical equations or a polynomial of up to 11th degree, and displays the fitted curve (up to three at one time) against a background of the data points. Options include reading in new data, rescale of axes, deleting all displayed curves, deleting points, adding new points, restoring all original or selected deleted points, specifying constants, and calling for CALCOMP plotter or quick look hard copy of output. Author (GRA)

N77-20915# Naval Postgraduate School, Monterey, Calif.
THE SYSTEM APPROACH TO MANAGEMENT: A PARADIGM FOR THE TEST AND EVALUATION PROCESS M.S. Thesis
William Michael Branch Sep. 1976 86 p refs
(AD-A032381) Avail: NTIS HC A05/MF A01 CSCL 05/1

This thesis addresses the Test and Evaluation process and demonstrates, through application of a dynamic systems model, that the Test and Evaluation process is a conglomerate of lower-order systems. Each system can be characteristically analyzed by focusing on objectives, input/outputs, interfaces, environmental, and effectiveness dimensions. Hence, the systems approach to management is suggested as a paradigm for the Test and Evaluation process. This approach provides a systematic way of thinking about the job of management and emphasizes viewing the Test and Evaluation system as a whole instead of as segregated parts. The classic functions of management can be put in juxtaposition with the phases of test and Evaluation to provide a better insight to management of scarce resources. Implementation of a strategy is perhaps the most important first step in practically using the systems approach and as such stimulates the manager to think in the proper perspective. Author (GRA)

N77-20916# Naval Postgraduate School, Monterey, Calif.
AN HEURISTIC SCHELDULING ALGORITHM FOR RESOURCE-CONSTRAINED PROJECT NETWORKS M.S. Thesis
Stewart Iden Marsh, Jr. Dec. 1976 41 p refs
(AD-A031819) Avail: NTIS HC A03/MF A01 CSCL 05/1

An algorithm is proposed for scheduling project networks having a single constraining resource and a constant level of available resources. The algorithm seeks to generate a minimum length schedule indirectly by maximizing the average resource utilization over the two time intervals represented by the current decision point and its successor. An attempt is made to schedule all of the activities whose predecessors have been completed; failing this, all feasible subsets are considered. Where possible, the algorithm considers only those subsets which introduce new activities at the subsequent decision point. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N77-20917 Consultants Bureau, New York.
PROBLEMS OF INFORMATION TRANSMISSION

V. I. Siforov, ed. Jan. 1977 86 p refs Transl. into ENGLISH of Problemy Peredachi Informatsii (USSR), v. 12, no. 1, Jan. - Mar. 1976, p 1-118
(PRITA9-12(1)-1-84-(1976)) Copyright. Avail: Consultants Bureau, 227 West 17th Street, New York, N. Y.; HC $50.00

A scheme for constructing generalized cascade codes that entails no constraints on the linearity of the initial codes is proposed. The procedure consists of a direct generalization of the cascade method of constructing binary codes from three initial codes. Use of such a procedure permits the imposition of certain additional requirements on the weighting spectrum of the resultant codes and to construct codes with specified minimum and maximum distances as well as equilibrium codes. Author

N77-20918*# Washington Univ., St. Louis, Mo. Center for Development Technology.
PROGRAM ON EARTH OBSERVATION DATA MANAGEMENT SYSTEMS (EODMS), APPENDIXES Final Report
L. F. Eastwood, John Kenneth Gohagan, Christopher T. Hill, Robert P. Morgan, Sall M. Bay, Trude K. Foutch, Timothy R. Hays, Richard J. Ballard, Kevin P. Makin, and Margaret A. Power 31 Dec. 1976 214 p refs
(Contract NAS5-20680)
(NASA-CR-153452) Avail: NTIS HC A10/MF A01 CSCL 05B

The needs of state, regional, and local agencies involved in natural resources management in Illinois, Iowa, Minnesota, Missouri, and Wisconsin are investigated to determine the design of satellite remotely sensed derivable information products. It is concluded that an operational Earth Observation Data Management System (EODMS) will be most beneficial if it provides a full range of services - from raw data acquisition to interpretation and dissemination of final information products. Included is a cost and performance analysis of alternative processing centers, and an assessment of the impacts of policy, regulation, and government structure on implementing large scale use of remote sensing technology in this community of users. Author

N77-20919*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SCIENTIFIC AND TECHNICAL INFORMATION OUTPUT OF THE LANGLEY RESEARCH CENTER FOR CALENDAR YEAR 1976
1976 124 p refs
(NASA-TM-X-74612) Avail: NTIS HC A02/MF A01 CSCL 05B

This document contains a listing of the scientific and technical information that the Langley Research Center was responsible for producing during the calendar year of 1976. NASA Technical Reports, Technical Notes, Technical Memorandums, Special Publications, Contractor Reports Journal Articles, and Technical Presentations made at society meetings are included. Author

N77-20920# National Commission on Libraries and Information Science, Washington, D. C. Domestic Council Committee on the Right of Privacy.
NATIONAL INFORMATION POLICY Report to the President of the United States
1976 252 p refs
Avail: NTIS MF A01; SOD HC $4.65 as 052-003-00296-5

Issues and discussions are presented for public policy questions generated by advances in computer and communications technology, by shifts in the United States economy from a manufacturing to an information base, and by citizen demands for clarification of their rights to have and control information. Recommendations are included. Author

N77-20921# Oak Ridge National Lab., Tenn.
BIOMEDICAL COMPUTING TECHNOLOGY INFORMATION CENTER (BCTIC) SHARING PROGRAM, DATA, AND INTERFACE DESIGN
Betty F. Maskewitz, R. L. Henne, and W. J. McClain 1976 10 p refs Presented at Conf. on Productivity through Instrumentation and Control, Houston, Tex., 10 Oct. 1976
(Contract W-7405-eng-26)
(CONF-761007-2) Avail: NTIS HC A02/MF A01

In response to a recognized need to facilitate computing technology transfer in biomedicine, the Biomedical Computing Technology Information Center (BCTIC) was established by the Division of Biomedical and Environmental Research (DBER) of the U.S. Energy Research and Development Administration (ERDA) at the Oak Ridge National Laboratory in July of 1975. The problems BCTIC has set out to solve and its functions are described. ERA

N77-20922# Brookhaven National Lab., Upton, N.Y.
INFORMATION CENTER AS A LINK BETWEEN BASIC AND APPLIED RESEARCH
S. Pearlstein 1976 15 p refs Presented at 5th CODATA Conf., Boulder, Colo., 28 Jun. - 1 Jul. 1976
(Contract E(30-1)-16)
(BNL-21554; Conf-760643-3) Avail: NTIS HC A02/MF A01

The National Neutron Cross Section Center (NNCSC) concerns itself with neutron physics information of a basic and applied nature. Computerized files of bibliography to the neutron physics literature, and of experimental and evaluated neutron data are maintained. The NNCSC coordinates a national effort, the Cross Section Evaluation Working Group (CSEWG) with participants from government, private, and academic institutions, to establish a computerized reference data base Evaluated Nuclear Data File (ENDF/B) for national programs. Power reactor, shield design, neutron data, radioactive decay data and radiation spectra for the burnup and after decay heat of fission products and photon interaction data for gamma ray transport calculations are covered. ERA

N77-20923# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS PRELIMINARY REPORT Interim Report, 8 Oct. 1975 - 8 Oct. 1976
8 Oct. 1976 59 p refs
(PB-260373/6) Avail: NTIS HC A04/MF A01 CSCL 05B

The legislative history surrounding the formation of CONTU the activities of the commission's first year are described. Topics discussed include the development of photocopying guidelines for inclusion in the new copyrightability of computer programs. Also provided is a summary of the commission's future plans in each area covered by legislative mandate. A list of all persons who appeared before the Commissioners through September 1976 is included as an appendix along with biographies of the members of the commission. GRA

N77-20924# National Library of Medicine, Bethesda, Md.
PERMUTED MEDICAL SUBJECT HEADINGS, 1977
Nov. 1976 300 p
(PB-259021/4; NLM-MED-76-07) Avail: NTIS HC A13/MF A01 CSCL 05B

Presented is a computer generated display of all terms, including major descriptors, minor descriptors, and entry terms, in the National Library of Medicine's Medical Subject Headings (MeSH) for 1977. The Permuted MeSH takes each significant word that appears in any MeSH term and then lists all the terms in which that word appears. In the listing, the significant word appears at the margin, and indented under it, all the terms containing the same word are grouped together in alphabetic order by the first word in the phrase. GRA

N77-20925# Environmental Protection Agency, Washington, D.C. Library Systems Branch.
EPA LIBRARY DATA PROCESSING SYSTEMS PROCEDURES AND USERS' GUIDE
Evelyn A. Moore Aug. 1976 50 p
(PB-258487/8; EPA-LIB-76-07) Avail: NTIS HC A03/MF A01 CSCL 05B

The EPA Library System consists of several information centers and 28 libraries. The EPA Library System is supported by computer systems covering journal and hard bound book holdings, journal check-in, circulation, document control, EPA Reports, international exchange items and specialized subject area collections. All Systems except circulation produce hard copy and Computer Output on Microform (COM) indexes, bibliographies and special reports. GRA

N77-20926# Midwest Research Inst., Kansas City, Mo.
FINE PARTICLE EMMISSIONS INFORMATION SYSTEM:

SUMMARY REPORT (SUMMER 1976) Summary Report, Oct. 1975 - May 1976
M. P. Schrag and A. K. Rao Jun. 1976 208 p refs
(Contract EPA-68-02-1324)
(PB-258825/9; EPA-600/2-76-174) Avail: NTIS HC A10/MF A01 CSCL 13B

Tests on 33 types of fine particle emissions sources and a variety of conventional and novel control devices are discussed. Particle size distributions are given from 700 test runs or sampling events, utilizing impactors of various types, optical particle counters, and diffusion batteries for the fine particle measurements. Data acquisition activities, data acquired relative to the effectiveness of particle control technology, and the current state of the Fine Particle Emissions Information System data base are assessed. Particulate sampling and sizing techniques and particulate-related health effects are included. GRA

N77-20927# Mathematics and Computation Lab., Washington, D. C. Information Science Div.
INFORMATION MANAGEMENT SYSTEM REFERENCE MANUAL Final Report
Edgar M. Cagley, David L. Parrish, Nathan J. Ray, and Richard H. Vaughan Oct. 1976 155 p Revised Sponsored by GSA
(PB-258915/8; GSA/FPA/MCL-TM-208-Rev-4) Avail: NTIS HC A08/MF A01 CSCL 09B

Information Management System (IMS) is a user-oriented information management system which facilitates the manipulation of data files on the UNIVAC 1100 Series computing equipment, operating under standard releases of the operating system. IMS features a query language based on a keyword concept and a random access technique that allows for rapid on-line updating as well as retrieval of data. IMS provides a file definition facility that allows users to associate meaningful names with data fields and subsequently to manipulate the data by using the associated names as variables. GRA

N77-20928# Engineering Index, Inc., N.Y.
ESTABLISHING AND MARKETING AN ENERGY INFORMATION SERVICE Final Report
John E. Creps, Jr. May 1976 43 p
(Grant NSF GN-42269)
(PB-259297/0; EIX-76/01) Avail: NTIS HC A03/MF A01 CSCL 05B

The data base is derived from the energy portion of the ENGINEERING INDEX data base augmented by repackaged abstracts obtained from cooperating secondary services. Direct mail, selective journal advertising, direct sales calls and conference exhibiting were used to promote the new service. GRA

N77-20929# Pan American Health Organization, Washington, D. C.
PAN AMERICAN ENVIRONMENTAL INFORMATION EXCHANGE SEMINAR ON INTERNATIONAL EXCHANGES
1976 23 p Conf. proc. held at Washington, D.C., 15-26 Mar. 1976 Prepared in cooperation with EPA and NTIS
(PB-259666/6) Avail: NTIS HC A02/MF A01 CSCL 05B

The first Pan-American Environmental Information Exchange Seminar was held in Washington, March 15-26 1976. Specific objectives of the meeting were: (1) to introduce Latin American countries to environmental information services in the United States; (2) to review the cooperative EPA-NTIS program both to illustrate the concept and operations of an environmental center utilizing the services of a central documents and information dissemination service, and to explain EPA/NTIS services available under the International Documents Exchange; (3) to provide a state of the art review of microtechnology as an advanced tool in information storage and retrieval; and (4) to draft guidelines for regional coordination of national environmental information systems and procedures for sharing services and products. GRA

N77-20930# Purdue Univ., Lafayette, Ind. Health Services Research and Training Program.
DEVELOPMENT, TESTING, AND EVALUATION OF ALTERNATIVE HEALTH SERVICES DATA SYSTEMS AND COMPONENTS Progress Report, 29 Sep. - 28 Dec. 1971
Robert Eichhorn 1971 85 p refs
(Contract HSM-110-71-150)
(PB-259787/0; NCHSR-76/206) Avail: NTIS HC A05/MF A01 CSCL 05B

Progress in a project for the development, testing, and evaluation of alternatives for health services data systems is described. The following items are included in the appendices: (1) classification of health data sets, (2) a list of data services and systems, (3) a review of utilization literature, (4) an overview of utilization, and (5) a key to indices and correlates of use. A paper is also presented which examines the evidence linking utilization with socioeconomic status. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-20931# Brookhaven National Lab., Upton, N.Y.
DYNAMICS SYSTEMS ANALYSIS OF THE RELATION BETWEEN ENERGY AND THE ECONOMY
David L. Behling, Jr. Jul. 1976 17 p refs Presented at 13th Inst. of Elec. and Electron. Eng. Computer Soc. Intern. Conf., Washington, D. C., 7 Sep. 1976
(Contract E(30-1)-16)
(BNL-21667; Conf-760933-1) Avail: NTIS HC A02/MF A01

An integrated system of energy and economic models is developed for use in assessing the energy and economic impact of a wide range of government energy policies. The system incorporates detailed engineering information for a wide range of potential new energy technologies and relates implementation levels of these new technologies to the structure of the energy sector and to such economic aggregates as the level and rates of change of income, output, employment, and prices. ERA

N77-20932# Martin Marietta Aerospace, Orlando, Fla. Technical Information Center.
LIFE-CYCLE COSTING. A SELECTED BIBLIOGRAPHY
Lucille McClure Oct. 1976 29 p refs
(AD-A030554; RB-330-1) Avail: NTIS HC A03/MF A01 CSCL 14/1

Life-Cycle Costing is a Department of Defense management concept that is applied in estimating costs during the acquistion of complete defense systems. The concept of Life-Cycle Costing has been around for several years. A great many of these years has been spent on bringing together policy, procurement, record keeping, financial control, and reliability cost estimates. The Air Force has made the greatest use of this concept but usually on small contracts. Only recently has Life-Cycle Costing become a prime consideration for all of the Armed Services. The main problem, particularly in estimating costs of undefined weapon systems, was the lack of a data base. The few attempts made in collecting data became so cumbersome that the sheer volume was uncontrollable. Several hundred Life-Cycle Cost models have been introduced but the cost estimates remained unrealistic. To overcome this problem, the Department of Defense has started a data base collection and storage system on the operating and support costs of some of the major weapon systems. This data base should help estimators in establishing trade-offs and projecting more realistic cost goals. GRA

N77-20933# Research Triangle Inst., Research Triangle Park, N.C.
ENERGY AND ECONOMIC IMPACTS OF MANDATORY DEPOSITS Final Report
Sep. 1976 752 p refs Prepared in cooperation with Franklin Assoc., Prairie Village, Kans.
(Contract FEA-CO-04-50175-00)
(PB-258638/6; FEA/D-76/406) Avail: NTIS HC A99/MF A01 CSCL 05C

The energy, capital and labor impacts that would be caused by a five cent deposit on beer and soft drink containers are examined. The range of potential impacts that could occur given various market responses to a nationwide mandatory deposit law is also discussed. GRA

N77-20934# Research Triangle Inst., Research Triangle Park, N.C.

ENERGY AND ECONOMIC IMPACTS OF MANDATORY DEPOSITS. EXECUTIVE SUMMARY
Sep. 1976 18 p Prepared in cooperation with Franklin Assoc., Prairie Village, Kans.
(Contract FEA-CO-04-50175-00)
(PB-258637/8; FEA/D-76/405) Avail: NTIS HC A02/MF A01 CSCL 05C

The impact of proposed mandatory national beverage container deposit legislation was investigated. Specific impacts that the imposition of a 5-cent refundable deposit on all beer and soft drink containers would have on the total beverage related industry were examined. These impact areas were (1) changes in annual energy consumption, (2) changes in capital investment requirements (in terms of fixed plant and equipment), and (3) changes in labor requirements (in terms of jobs and earnings). These impacts were developed for those industries in the total beverage system that would be most affected by changes caused by a mandatory deposit. The industries included are: retailers, beverage producers and distributors, container manufacturers and producers of basic steel and aluminum. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N77-20935# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1977
Washington GPO 1976 56 p Rept. on H.R. 12453 of Comm. on Aeronautical and Space Sci., 94th Congr., 2d Sess., 30 Mar. 1976
(GPO-57-010) Avail: US Capitol, Senate Document Room

A Senate bill authorizing appropriations to NASA totaling $3,696,850,000 is presented. The space budgets of other agencies are included. A.R.H.

N77-20936# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1977 208 p Rept. to accompany H.R. 4088 from Comm. on Sci. and Technol., 95th Congr., 1st Sess., 10 Mar. 1977
(H-Rept-95-67) Avail: US Capitol, House Document Room

The bill authorizing appropriations for NASA research and development, construction of facilities, and research and program management is presented. Included are cost and budget data, the effect of legislation on inflation, changes in existing law, oversight findings and recommendations, and estimates and comparisons from the Congressional Budget Office. A.R.H.

N77-20937# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1978. PART 1: BUDGET DETAIL SUBMITTED BY NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1977 733 p refs Hearings on S. 365 before Comm. on Commerce, Sci., and Transportation, 95th Congr., 1st Sess., 1977
(GPO-84-105) Avail: Comm. on Commerce, Sci., and Transportation

A bill is presented that authorizes appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, research and program management, and for other purposes. Author

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N77-20938*# National Academy of Public Administration, Washington, D.C.
THE BALTIMORE APPLICATIONS PROJECT: A NEW LOOK AT TECHNOLOGY TRANSFER
Mar. 1977 116 p
(Contract NAS5-23564)
(NASA-CR-152462) Avail: NTIS HC A06/MF A01 CSCL 05A

The history of cooperation between Goddard Space Flight Center and Baltimore City administrators in solving urban problems is summarized. NASA provided consultation and advisory services as well as technology resources and demonstrations. Research and development programs for 69 tasks are briefly described. Technology utilization for incinerator energy, data collection, Health Department problems, and solarization experiments are presented as case histories. A.H.

N77-20939# Sandia Labs., Albuquerque, N.Mex.
BENEFICIAL USES PROGRAM Progress Report, period ending 31 Mar. 1976
Jul. 1976 54 p refs
(Contract E(29-1)-789)
(SAND-76-0231) Avail: NTIS HC A04/MF A01

Cost beneficial uses of existing and future surplus radioactive materials were examined. Utilization of Cs-137 as a gamma source to sterilize sewage sludge for safe application as a fertilizer or as an animal feed supplement was considered. Inactivation rates were determined for Salmonella species, coliforms, and fecal strep in sewage sludge when radiation and thermoradiation were applied while bubbling O2 through the sludge. ERA

N77-20940# National Swedish Road and Traffic Research Inst., Linkoeping.
SAFETY PROBLEMS IN COMMERCIAL VEHICLE HANDLING
Lennart Strandberg, Olle Nordstroem, and Staffan Nordmark 1975 67 p refs Presented at the Symp. on Com. Vehicle Braking and Handling, Ann Arbor, Mich., 5-7 May 1975 Sponsored in part by Natl. Swed. Road Safety Office and Transport Res. Delegation
(VTI-82-A) Avail: NTIS HC A04/MF A01

Research on the dynamic behavior of heavy vehicle combinations and proposed regulations on handling performance are reviewed. Revealed safety problems are listed and some steps towards better safety are suggested. The research was concentrated on the handling performance in a double lane change maneuver studied by means of digital computer simulation. The 10 degrees-of-freedom driver-vehicle simulation model used in these studies was validated by full scale tests. Several studies on overturning stability were performed, such as: full scale static tests; lateral sloshing effects studied by means of servo operated scale models connected to an analog computer; and studies of relations between driver estimated and calculated overturning risk in real traffic. The low speed off-tracking problem was investigated separately, and its interactions with high-speed behavior are discussed. Author (ESA)

N77-20941# Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
MATHEMATICAL MODELING OF HETEROGENEOUS SORPTION IN CONTINUOUS CONTACTORS FOR WASTEWATER DECONTAMINATION: INFLUENCE OF REVERSIBILITY AND CHROMATOGRAPHIC EFFECTS ON SYSTEM DESIGN AND OPERATION Final Report, 1 Jul. 1973 - 30 Jun. 1974
Thomas M. Keinath, Hyman Karesh, Samuel Lowry, and Mohamed S. Abdo Apr. 1976 184 p refs

(Contract DADA17-73-C-3154)
(AD-A031179) Avail: NTIS HC A09/MF A01 CSCL 13/2

As water quality standards have become more stringent, there has been an increasing interest in the use of activated carbon for the removal of trace contaminants. Accordingly, the objective of this study was to develop a predictive model for adsorption of multiple solutes from solution onto activated carbon using a differential contacting system. To accomplish this goal, two secondary objectives had to be achieved. These were (1) to evaluate existing multi-solute adsorption equilibria models and (2) to determine how adsorption reversibility and chromatographic effects would influence the design and subsequent operation of prototype adsorbers. Numerous adsorption equilibrium studies were conducted using bi-solute combinations of o-phenylphenol (OPP), dinitro-o-sec-butyphenol (DNOSBP), and 2,4-dichlorophenol (2,4-DCP). Results of these studies were employed to evaluate the utility of the Longmuir Competitive, Longmuir Semi-Competitive Ideal Solution Theory and Graphical Models of competitive adsorption equilibria. Neither of the models was found to adequately describe competitive adsorption effects. Nonetheless, the Graphical approach gave the best estimate of competitive interactions. GRA

N77-20942# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.
EVALUATION OF NEW REVERSE OSMOSIS MEMBRANES FOR THE SEPARATION OF TOXIC COMPOUNDS FROM WASTEWATER Final Report, Sep. 1974 - Aug. 1975
Edward S. K. Chian, Martin N. aschauer, and Herbert H. P. Fang Jun. 1976 323 p refs
(Contract DADA17-73-C-3025)
(AD-A030884; UILU-ENG-75-2028) Avail: NTIS HC A14/MF A01 CSCL 13/2

This final report presents the results of a project entitled 'Evaluation of New Reverse-Osmosis Membranes for the Separation of Toxic Compounds from Wastewater'. The objectives of the third and last year of this study were to evaluate the engineering parameters involved in applying the NS-100 membrane to the treatment of wastewater. The tasks included optimizing the casting of tubular NS-100 membranes, evaluating the chemical stability of NS-100 toward oxidants, studying the effects of additives on the ability of the membrane to maintain its performance, and developing a computer program for the design of a large treatment plant using the results of tests on single tubes and tubular modules. GRA

N77-20943# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
RESIDUAL WASTE BEST MANAGEMENT PRACTICES: A WATER PLANNER'S GUIDE TO LAND DISPOSAL
Jun. 1976 290 p refs
(Contract EPA-68-01-3503)
(PB-258849/9; EPA-440/9-76-022) Avail: NTIS HC A13/MF A01 CSCL 13B

This planner's handbook describes residual wastes from nine most frequently encountered sources and relates management of these wastes to exhaustive enumeration of BMP's. This will provide the potential users-planners, engineers, administrators, lawyers, elected officials and others, with a reference for carrying out their residual waste management responsibilities under areawide or State water quality management planning programs and other regional/local activities. GRA

N77-20944# Raytheon Co., Portsmouth, R.I. Submarine Signal Div.
WASTEWATER SAMPLING, TRANSFER AND CONDITIONING SYSTEM Final Report, Jun. 1973 - Mar. 1975
Louis S. Dicola Oct. 1976 80 p
(Contract EPA-68-03-0250)
(PB-259906/6; EPA-600/2-76-146) Avail: NTIS HC A05/MF A01 CSCL 13B

An automatic on-line hardware system was constructed and field evaluated for reliably sampling, transferring, and conditioning various wastewater-treatment process streams such that the resulting transferred and conditioned samples are suitable for interfacing with automatic on-line colorimetric and total organic carbon analyzers. Process streams to which this hardware system was sucessfully applied included raw sewage, primary effluent, secondary effluent, aeration tank mixed liquor, and return activated sludge. Analytical parameters used to evaluate the hardware system included both total and soluble organic carbon, orthophosphate, total hydrolyzable phosphate, and ammonia nitrogen. GRA

N77-20945# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
CATALYTIC WASTE TREATMENT SYSTEMS FOR GREAT LAKE ORE CARRIERS Final Report, 1971 - 1973
Sheldon E. Moore, Robert W. Coleman, and Peter E. Lakomski Sep. 1976 66 p
(Grant EPA-S-802730)
(PB-260362/9; EPA-600/2-76-147) Avail: NTIS HC A04/MF A01 CSCL 13B

One of the major inland waterways of the United States subject to heavy commercial and recreational boating traffic and associated pollution is the Great Lakes. The objectives were to develop and demonstrate physical-chemical waste treatment systems to treat the various waste streams (sanitary, galley, shower, and washwater) aboard an operating ore carrier on the Great Lakes. The program resulted in the demonstration of two such systems installed aboard the Cleveland-Cliffs Iron Company ore carrier, SS Cliffs Victory. GRA

N77-20946# Wisconsin Univ., Oskosh.
WASTEWATER TREATMENT BY NATURAL AND ARTIFICIAL MARSHES Final Report, Jun. 1972 - Jun. 1976
Frederic L. Spangler, William E. Sloey, and C. W. Fetter, Jr. Sep. 1976 184 p refs
(Grants EPA-R-803794; EPA-S-801042)
(PB-259992/6; EPA-600/2-76-207) Avail: NTIS HC A09/MF A01 CSCL 13B

Investigations were conducted on the use of artificial and natural marshes as purifiers of effluent from municipal treatment plants. Observations were made on marsh influent and effluent quality. Phosphorus distribution in the ecosystem and removal by harvesting were studied. Responses of the vegetation to repeated harvesting were recorded. Artificial marshes consisted of plastic-lined excavations containing emergent vegetation, especially Scirpus validus, growing in gravel. Various combinations of retention time, primary effluent, secondary effluent, basin shape, and depth of planting medium were studied. A polluted natural marsh was studied simultaneously. GRA

N77-20947# Utah State Univ., Logan. Inst. of Ecology.
ECOSYSTEM IMPACTS OF URBANIZATION ASSESSMENT METHODOLOGY Final Report
David L. Jameson, ed. (Houston Univ.) Jul. 1976 247 p refs
(Contract EPA-68-2642)
(PB-259931/4; EPA-600/3-76-072) Avail: NTIS HC A11/MF A01 CSCL 13B

A methodology which uses space-time analysis and ecosystem modeling to assess the secondary impacts of wastewater treatment facilities on the ecosystem is presented. The existing state of the ecosystem is described with emphasis on the dynamic, periodic, trend, and gradient processes. Ecosystem models are used to forecast consequences of project alternatives. Incremental and synergistic effects are indicated along with suggested operational adjustments to minimize ecosystem impacts from the recommended project. The usefulness of the components of ecosystem models is demonstrated. The changes in current methodologies which are required to adopt space-time analysis and ecosystem modeling to the assessment of the effects of urbanization on the ecosystem are indicated. GRA

N77-20948# Midwest Research Inst., Kansas City, Mo.
A STUDY OF WASTE GENERATION, TREATMENT AND DISPOSAL IN THE METALS MINING INDUSTRY Final Report, Jun. 1974 - Jul. 1976
David Bendersky, Robert E. Gustafson, Charles E. Mumma, Kenneth R. Walker, and Dennis Costello Oct. 1976 407 p refs
(Contract EPA-68-01-2665)
(PB-261052/5; EPA/SW-132C) Avail: NTIS HC A18/MF A01 CSCL 13B

The primary objective of the program was to provide EPA with detailed information concerning the generation, treatment, and disposal of potentially hazardous wastes in the metals mining

and concentrating industries. Waste disposal and treatment practices are discussed, and estimates are given for the cost of hazardous waste treatment and disposal at typical facilities. GRA

N77-20949# Little (Arthur D.), Inc., Cambridge, Mass.
WASTE CLEARINGHOUSES AND EXCHANGES: NEW WAYS FOR IDENTIFYING AND TRANSFERRING REUSABLE INDUSTRIAL PROCESS WASTES Final Report
Robert C. Terry, Jr., Joan B. Berkowitz, C. Michael Mohr, Joseph Tratnyek, and John T. Funkhouser Oct. 1976 148 p refs
(Contract EPA-68-01-3241)
(PB-261287/7; ADL-C-78494; EPA/SW-130C) Avail: NTIS HC A07/MF A01 CSCL 13B

The experience of the industrial waste information clearinghouses operating since 1972 in ten European countries, explores opportunities for the waste transfer concept in the United States, outlines the requirements for successful transfer organizations, and describes their techniques and procedures. The study analyzes concepts and requirements for transferring wastes, distinguishing between trash waste, having no reuse value whatever, and scrap waste, having some reuse value. It identifies and estimates quantities of industries process wastes suitable for transfer, especially in the Philadelphia SMSA. GRA

N77-20950# American Society of Civil Engineers, New York.
COMPUTERIZED CITY-WIDE CONTROL OF URBAN STORMWATER
Neil S. Grigg, John W. Labadie, George R. Trimble, Jr., and David A. Wismer Feb. 1976 92 p refs Sponsored by Office of Water Resources Research and the US Geological Survey
(PB-260684/6; NSF/RA-760296) Avail: NTIS HC A05/MF A01 CSCL 13B

Information and guidelines are given for local government water resource supervisors who are considering the incorporation of automation in their sewer applications. A combined sewer system, as a particular kind of urban stormwater system can be defined as a working process that includes: (1) inputs--storm rainfall and sewage waste flows and their collection, transport, treatment, and disposal operations; and (2) outputs--treatment plant effluents overflow, and unaccommodated flow waters. A computer control project should proceed cautiously through phases, beginning with the simple to the more complex. GRA

N77-20951# Johnson and Anderson, Inc., Pontiac, Mich.
EVALUATION OF FLOW EQUALIZATION AT A SMALL WASTEWATER TREATMENT PLANT Final Report
Gerald W. Foess, James G. Meenahan, and J. Michael Harju Sep. 1976 60 p refs
(Contract EPA-68-03-0417)
(PB-260375/1; EPA-600/2-76-181) Avail: NTIS HC A04/MF A01 CSCL 13B

The impact of flow equalization on the 0.092 cu m/sec (2.1 mgd) activated sludge plant at Walled Lake/Novi, Michigan was evaluated. Process streams were characterized for a twelve-month period under equalized flow conditions with respect to BOD, total suspended solids and total phosphorus. The effects of the equalization basin on final settling and filtration were evaluated by two studies, one with and one without equalization of flow. Flow equalization was effective in leveling influent flow variations but had very little effect upon concentration leveling. Performance of the multimedia filters was superior under the equalized flow, both in terms of average removal efficiency and consistency. GRA

N77-20952# Maryland Univ., College Park. Dept. of Sociology.
A METHODOLOGY FOR SOCIAL IMPACT ASSESSMENTS OF HIGHWAY LOCATIONS Interim Report, 1975 - 1976
Kurt Finsterbusch Jul. 1976 107 p refs Sponsored by Maryland State Highway Administration
(PB-259820/9; FHWA-MD-R-76-20) Avail: NTIS HC A06/MF A01 CSCL 13B

Social impacts are defined and the full range of potential social impacts of highways are listed both by topical categories and by stages of the highway location. Three important social impacts for residents are discussed in some detail. Displacement is examined for its economic and psychological effects. The possible effects of highway noise on nearby residents and the general effects of highways on property values are also discussed. Four commonly used procedures for highway locations studies are reviewed and improvements are recommended. These procedures are: field investigation of displacement, map analysis, community social profile, and the report on public meetings. GRA

N77-20953# Repro Chemical Corp., Washington, D. C.
CONVERTING CHLOROHYDROCARBON WASTES BY CHLOROLYSIS Final Report, Jan. 1975 - Jun. 1976
James K. Shiver Oct. 1976 70 p refs
(Contract EPA-68-03-0456)
(PB-259935/5; EPA-600/2-76-270) Avail: NTIS HC A04/MF A01 CSCL 13B

The magnitude of the waste chlorohydrocarbon problem in the U.S. was assessed, and the applicability of the conversion of this waste by chlorolysis as a means of resolving the problem was studied. An estimated 86,400 metric tons per year of chlorohydrocarbon waste is generated in the U.S. A portion of this waste is treated by chlorolysis to solvents, and by incineration. The balance is disposed of by deep well injection or burial. The identified waste is a suitable feedstock for a chlorolysis operation if it is pretreated to remove particulate materials and moisture. Geographically, the waste is generated primarily along the Gulf Coast, from Corpus Christi to New Orleans. The Gulf Coast concentration indicates that a regional waste disposal facility (including a chlorolysis unit, a waste pretreatment unit, and a conventional incineration unit) would be viable. Preparation of a design and firm capital estimate is recommended as the next step in an overall program leading to such a regional facility. GRA

N77-20954# Denver Research Inst., Colo.
FEDERAL INCENTIVES FOR INNOVATION. WHY INNOVATIONS FALTER AND FAIL: A STUDY OF 200 CASES
Sumner Myers and Eldon E. Sweezy Jan. 1976 85 p refs
(Contract NSF C-860)
(PB-259208/7; NSF/RA-760232; R-75-04) Avail: NTIS HC A05/MF A01 CSCL 05A

Innovations that pass initial screenings but fail after entering the pipe-line are studied. Actual industrial innovations that fail and attempts to determine why they fail are examined with a view to suggesting public policies that might decrease the rate of failure. The obstacles to innovative success as identified by management officials involved in decisions to scrap innovations are cited, and these obstacles are related to other aspects of the innovation process, such as the stages of development at which decisions are made to scrap innovations and the attitudes of management toward these decisions. GRA

N77-20955# Utah Univ., Salt Lake City. Dept. of Mechanical and Industrial Engineering.
PROCEEDINGS OF THE WESTERN REGIONAL WORKSHOP ON TECHNOLOGY ASSESSMENT
Richard E. Turley and Wyatt M. Rogers, Jr. Jul. 1976 68 p refs Proc. held at Salt Lake City, 11-13 Jun. 1975; sponsored in part by Utah State Advisory Council on Science and Technology, Western Interstate Nuclear Board, and Federation of Rocky Mountain States Sponsored in part by Utah State Advisory Council on Science and Technology, Western Interstate Nuclear Board, and Federation of Rocky Mountain States
(Contract NSF ISR-75-06142)
(PB-259040/4; NSF/RA-760222) Avail: NTIS HC A04/MF A01 CSCL 05A

The West is in the midst of preparing for the jolt it will experience in many areas, especially in energy and mineral development. There are many challenges and problems common to the Rocky Mountain States: roads need to be built, tax revenue laws and procedures need to be reevaluated, municipal services in prospective boomtowns in most cases are already at capacity, the scenic western environment needs to be preserved, social equities need to be defined, and the social risks and impacts, brought about by the national need to develop western resources, need to be balanced with commensurate benefits. This workshop provides an analytical base of this region, and helps to insure that future decisions and policies are made with as much knowledge as possible. Attendees principally include

state governments, industry, and academia from the western states. GRA

N77-20956# Los Angeles County Dept. of Urban Affairs, Calif.
EXPEDITING DIVERSIFICATION OF DEPARTMENT OF DEFENSE CONTRACTORS Draft Final Report
Apr. 1976 136 p Prepared by Ultrasystems, Inc., Irvine, Calif.
(Contract EDA-07-6-01495-26)
(PB-259190/7; EDA-76-054) Avail: NTIS HC A07/MF A01 CSCL 05C

The primary goal of this study was the development of diversification techniques to ensure that defense dependent firms located in Los Angeles County could participate in high technology non-defense markets. The purpose was to develop and test, on a pilot basis, an economic diversification program designed to lessen the potential impact of defense contract cutbacks on the economy of Los Angeles. The key to any identification of diversification opportunities, whether it be market, product or capabilities diversification, is an up-to-date knowledge of future markets that pertain to the capability levels of the contractor group being assisted. GRA

N77-20957# Air Force Civil Engineering Center, Tyndall AFB, Fla.
WASTE POL DISPOSAL THROUGH ENERGY RECOVERY Final Report, 1 Feb. 1974 - 1 Jan. 1976
Patrick T. Fink and Jerry W. Jackson Jun. 1976 61 p refs
(AD-A031783; AFCEC-TR-76-2) Avail: NTIS HC A04/MF A01 CSCL 13/2

In order to investigate the practical feasibility of combusting waste POLS (petroleum, oil, lubricants) in heating plant boilers, a field testing program was undertaken to obtain actual performance and air pollution data. Since most Air Force heating plants Utilize FS-Grade (No 2, No 5) fuel or natural gas as a primary fuel source, emphasis was placed on the installation of waste POL systems at three separate Air Force bases employing the use of these fuels. Various percentages of waste POL were burned in the test boilers with the corresponding fluctuation in stack emissions documented. Results of this study are reported in terms of quantity and hours of waste POL burned per installation, operational procedures, air pollution data, and recommendations for the safe installation of a compatible waste POL system. Author (GRA)

N77-20958# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
NITRIFICATION AND HEAVY METAL REMOVAL IN THE ACTIVATED SLUDGE TREATMENT PROCESS Ph.D. Thesis
Paul Allen Richards Aug. 1976 184 p refs
(AD-A031748; AFIT-CI-7T-3) Avail: NTIS HC A09/MF A01 CSCL 13/2

A bench-scale, continuous flow, completely mixed activated sludge system was used to investigate the relationship of nitrification and other system parameters to heavy metal removal in the activated sludge waste treatment process. The heavy metals studied were chromium and silver. Analyses performed on the influent, mixed liquor, return sludge, and effluent included heavy metal concentration, pH, dissolved oxygen, temperature, suspended solids, chemical oxygen demand, nitrogen species, alkalinity, and other system control parameters. Results indicate that the sludge wasting rate is directly related to heavy metal removal. Nitrification is only indirectly related. A theory for the mechanisms contributing to heavy metal removal is developed. GRA

N77-20959# Computerized Pollution Abatement Corp., Leicester, N. Y. Pollution Abatement Div.
WASTE DISPOSAL STUDY. EVALUATION OF METHODS TO RECOVER REUSABLE CHEMICALS FROM EVAPORATED PHOTOWASTES Final Report, May 1974 - Nov. 1975
George A. Lorenzo and Thomas N. Hendrickson Wright-Patterson AFB, Ohio AFAL Sep. 1976 59 p refs
(Contract F33615-74-C-1091)
(AD-A031767; AFAL-TR-76-75) Avail: NTIS HC A04/MF A01 CSCL 13/2

The feasibility of recovering usable chemicals from evaporated photoprocessing wastes was studied. About 50-70% of the evaporated waste consists of sodium thiosulfate and sodium sulfite. Recovery of thiosulfate and sulfite was achieved via solubilization and either a combination of crystallization and subsequent barium precipitation of these desired sulfur salts, or direct barium precipitation. The barium salts could then be converted to the soluble sodium thiosulfate and sodium sulfite by action of sodium carbonate. Recovery efficiencies to 90% were achieved. Maximum yields were obtained when the sodium thiosulfate was greater than 50% of the waste, and water was used as the solubilizing agent. For wastes containing quantities lower than this concentrate, sodium hydroxide was the solvent of choice. The latter allowed separation of sulfite from thiosulfate. GRA

N77-20960# Naval Ship Research and Development Center, Bethesda, Md. Propulsion and Auxiliary Systems Dept.
EVALUATION OF SINGLE-PASS SEAWATER REVERSE OSMOSIS MODULES AND PRETREATMENT TECHNIQUES
J. F. Rizzino Oct. 1976 28 p ref
(AD-A031635; DTNSRDC-76-0121) Avail: NTIS HC A03/MF A01 CSCL 13/2

Four reverse osmosis modules were evaluated on natural seawater at Wrightsville Beach, North Carolina. Three of the modules were run on chlorinated and cartridge filtered seawater, and all showed permeate rate declines greater than 30% per thousand hours. The fourth module, run on chlorinated, ultrafiltered seawater feed showed an average permeate rate decline of 4.7% per thousand hours of operation after 3,800 total operating hours. Permeate total dissolved solids for all modules were consistently less than 500 parts per million. It was found that a high degree of filtration was necessary for the successful operation of reverse osmosis modules for seawater desalination. The use of electrolytically generated chlorine to prevent membrane biological attack (and/or fouling) and to produce chlorinated potable water without the use of any chlorine compounds was considered very successful. Author (GRA)

N77-20961# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
INVESTIGATION OF EFFLUENT FILTERING SYSTEMS FOR DREDGED MATERIAL CONTAINMENT FACILITIES
Raymond J. Krizek, Joseph A. FitzPatrick, and Dimitri Atmatzidis Aug. 1976 230 p refs
(Contract DACW39-74-C-0090)
(AD-A031468; WES-CR-D-76-8) Avail: NTIS HC A11/MF A01 CSCL 13/2

This study was conducted to establish the functional capabilities and performance characteristics of effluent filtering systems and to provide guidance for the design of filtering systems to improve the quality of effluent from dredged material containment facilities. All available data were collected, pertinent literature was reviewed, and about 300 laboratory and field filtration tests were conducted. Conventional, technically feasible systems were identified, new concepts were developed (pervious dikes, sandfill weirs, forced-choice-triangle olfactometer). An odor-abatement strategy is presented for handling the expected range of odor conditions at dredged material disposal sites. Its aim is to reduce to an acceptable level the perceived intensity of malodors in an affected community. The main steps in the strategy cover (1) selection of the disposal site, (2) site preparation, (3) odor characterization of sediments to be dredged, (4) malodor abatement during dredging and disposal operations, (5) malodor abatement after filling of the disposal site, and (6) the handling of malodor complaints. GRA

N77-20962# Rutgers Univ., New Brunswick, N.J. Dept. of Biochemistry and Microbiology.
BIODEGRADATION OF OIL SLICKS ON THE MARINE ENVIRONMENT Final Report, 1 Jan. 1970 - 31 Aug. 1976
Richard Bartha 1 Nov. 1976 14 p refs
(Contract N00014-67-A-0115-0005)
(AD-A031739) Avail: NTIS HC A02/MF A01 CSCL 13/2

The degradation of petroleum hydrocarbons by marine bacteria was studied with the ultimate aim of using this process in the cleanup of polluting oil. Hydrocarbon-utilizing marine bacteria were isolated and their growth requirements and metabolic

pathways were studied. Enzymatic and regulatory mechanisms responsible for the recalcitrance or delayed utilization of certain hydrocarbons, e.g. polynuclear aromatics and highly branched iso-alkanes were identified. The abundance and distribution of hydrocarbon degrading bacteria were measured in New Jersey coastal waters. The limiting factors of oil biodegradation in the marine environment were studied. Apart of the nature of the oil itself, water temperature and mineral nutrients (N, P, Fe) were found to be the most important limiting factors. Given favorable water temperatures, the rate of oil biodegradation can be increased by an order of magnitude or more by supplying the above mineral nutrients to a floating oil slick in oil-soluble (oleophilic) form. This method of application prevents nutrient loss by dilution and does not trigger algal blooms. The patented procedure is considered to be a new cost-effective way to cleanup oceanic oil spills. Author (GRA)

N77-20963# Environmental Protection Agency, Cincinnati, Ohio. Office of Technology transfer.

MANUAL OF METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTES

Jul. 1976 317 p

(PB-259973/6; EPA-625/6-76-003a) Avail: NTIS HC A14/MF A01; also available from Environmental Protection Agency, Office of Technology Transfer, Cincinnati, Ohio 45268 CSCL 07D

The chemical analytical procedures used in U.S. Environmental Protection Agency laboratories for the examination of ground and surface waters, domestic and industrial waste effluents, and treatment process samples are cited. Test procedures are provided for the measurement of physical, inorganic and selected organic constituents and parameters. GRA

N77-20964# Pennsylvania Univ., Philadelphia. Dept. of Civil and Urban Engineering.

DESIGN FOR A NATIONAL URBAN TRANSPORTATION REPORTING SYSTEM

Vukan R. Vuchi 1976 90 p Sponsored by Urban Mass Transportation Administration

(PB-259002/4; UMTA-PA-11-0002-76-1) Avail: NTIS HC A05/MF A01 CSCL 13B

The contents and uses of a National Urban Transportation Reporting System are discussed. A review of the PennDOT transit reporting system, its implementation and results are presented. A recommended set of data items and indicators is defined and analyzed. GRA

N77-20965# Transportation Systems Center, Cambridge, Mass.

URBAN RAIL SUPPORTING TECHNOLOGY: A FIVE YEAR PROGRESS SUMMARY Progress Report, 1971 - 1976

Jun. 1976 133 p

(Contract DOT-MA-06-0025)

(PB-259090/9; UMTA-MA-06-0025-76-7) Avail: NTIS HC A07/MF A01 CSCL 13B

Contents: Program management; Applications engineering and technical support; Facilities development; Test and evaluation; Technology development; Noise abatement; Tunneling; Safety and reliability. GRA

N77-20966# Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.

THE EFFECTS OF VARIOUS TERTIARY TREATMENT NUTRIENT REMOVAL SCHEMES ON PERIPHYTON COMMUNITIES IN MODEL LABORATORY STREAMS

Jerry C. Smrchek, John Jr. Cairns, Kenneth L. Dickson, Paul H. King, Clifford W. Randall, and John Crowe Jul. 1976 129 p refs

(PB-259010/7; VPI-WRRC-Bull-86; W77-00005; OWRT-B-039-VA(2)) Avail: NTIS HC A07/MF A01 CSCL 13B

A model stream system was established to study the effects upon periphyton communities of effluents from conventional or up to date tertiary treatment processes for nutrient(s) removal. Algal phytopigments, dry weight biomass, organic weight biomass, pigment diversity ratios, and primary productivity of these communities were studied during six different experiments. Laboratory scale treatment systems for ferric chloride coagulation, flocculation and dual media filtration processes were used in the phosphorus removal experiment and in the carbon and phosphorus experiment. GRA

N77-20967# Colorado State Univ., Fort Collins. Environmental Resources Center.

THE RELEVANCE OF TECHNOLOGICAL CHANGE IN LONG-TERM WATER RESOURCE PLANNING

Roger G. Kraynick and Charles W. Howe Jun. 1976 64 p refs

(Contracts DI-14-31-0001-3806; DI-14-31-0001-4006)

(PB-258719/4; Completion-74; W77-00113; OWRT-A-022-COLO(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

Trends of real unit costs associated with major sub-project tasks of large-scale water projects were derived. Real unit costs of large-scale excavation and other construction operations have declined significantly, but the separation of static scale economy effects from the effects of true technological change poses a difficult problem. Technological advances will contribute to the reduction of physical and engineering uncertainties in project construction and operation. A specific instance is geologic reconnaissance activities used in water project implementation, an activity which has benefited from great technological advance in the post-war period. GRA

N77-20968# Hydrocomp, Inc., Palo Alto, Calif.

THE USE OF CONTINUOUS SIMULATION IN THE EVALUATION OF WATER QUALITY MANAGEMENT PLANS

Anthony S. Donigian, Jr. and Ray K. Linsley Aug. 1976 97 p refs

(Contract DI-14-31-0001-5215)

(PB-258677/4; W77-00001; OWRT-C-6134(5215)(1)) Avail: NTIS HC A05/MF A01 CSCL 13B

A methodology was developed for the evaluation of water quality plans analogous to procedures used in flood control planning. The proposed methodology utilizes continuous water quality simulation to develop long term water quality information from which water quality frequency curves can be obtained. This frequency information allows the evaluation of the physical performance and impacts of proposed water quality control plans with specific consideration of the variable nature of the water resource. Using treatment costs and other economic indicators of water quality, the water quality frequency information can be used to estimate the cost effectiveness and economic efficiency of alternative plans. GRA

N77-20969# Environmental Protection Agency, Washington, D.C. Municipal Construction Div.

VALUE ENGINEERING WORKBOOK FOR CONSTRUCTION GRANT PROJECTS

Jul. 1976 70 p refs Sponsored in part by Culp, Wesner and Culp, Eldorado Hills, Calif.

(PB-258040/5; EPA/MCD-29; EPA-430/9-76-008) Avail: NTIS HC A04/MF A01 CSCL 13B

Procedures for applying Value Engineering (VE) techniques to wastewater treatment projects are described. The relationships between VE analyses and the EPA construction Grant Program are discussed. Information on organization of VE study plan and selection of a VE Team Coordinator is presented. Typical VE ideas and results for wastewater projects are presented. GRA

N77-20970# Environmental Protection Agency, Washington, D.C. Office of Water and Hazardous Materials.

GUIDELINES FOR PREPARATION OF WATER QUALITY MANAGEMENT PLANS

Sep. 1974 67 p

(PB-259444/8) Avail: NTIS HC A04/MF A01 CSCL 13B

The basin plan is a management document that identifies the basin's water quality problems and sets forth a remedial program to alleviate those problems. To achieve this objective, the basin plan is designed to provide the necessary analysis for basin management decisions. GRA

N77-20971# Environmental Protection Agency, Cincinnati, Ohio. Office of Technology Transfer.

CHOOSING THE OPTIMUM FINANCIAL STRATEGY FOR POLLUTION CONTROL INVESTMENTS

C. Marshall (JACA Corp.) and J. Commins (JACA Corp.) Jun.

1976 65 p refs
(PB-259443/0; EPA-625/3-76-005) Avail: NTIS HC A04/MF A01; also available from Environmental Protection Agency, Office of Technology Transfer, Cincinnati, Ohio 45268 CSCL 13B

This publication was designed to alert industry to qualifications for and availability of financial assistance from Federal, state and local governments, and will illustrate that it is well worth the time to analyze the special methods of financing pollution control expenditures and the available tax treatments. GRA

N77-20972# National Academy of Sciences - National Research Council, Washington, D. C. Ad Hoc Committee on Technology of Drilling for Energy Resources.
DRILLING FOR ENERGY RESOURCES
1976 84 p refs
(Contract NSF C-310)
(PB-259206/1; NSF/RA-760195) Avail: NTIS HC A05/MF A01 CSCL 08I

Current drilling technology was examined, and areas where additional research and development might significantly increase drilling rates and capabilities were suggested. A strategy for improving drilling technology was investigated. Emphasis is on the equipment and techniques used to drill for petroleum, natural gas, and geothermal resources. Author

N77-20973# Naval Postgraduate School, Monterey, Calif.
A REGIONAL CENTER FOR UTILIZATION AND TRANSFER OF TECHNOLOGY M.S. Thesis
Peter Scott Hughes and Milton Henry Olson Sep. 1976 268 p refs
(AD-A031873) Avail: NTIS HC A12/MF A01 CSCL 05/2

The need for a regional center to bridge the gap between existing sources of technology and state and local government as users of technology is exposed. A Regional Center for Utilization and Transfer of Technology is described and a demonstration project proposed. In support of the parent objective, questionnaires were sent out and interviews were held with city managers throughout the state of California. From the results, three aspects of the concept were explored in depth: (1) a description of the market for technology transfer (TT) to local government; (2) organization for TT; and (3) the measurement of effectiveness. Other areas covered include: barriers to TT; a survey of existing TT organizations; models of the TT process; a synopsis of Department of Defense policy on TT; and high potential tasks for a Regional Center. GRA

N77-20974# American Society of Civil Engineers, New York.
URBAN FLOOD WARNING AND WATERSHED MANAGEMENT ADVANCES IN METROPOLITAN MELBOURNE
C. T. Earl, J. W. Porter, J. A. Lanaway, Don G. Thompson, and A. S. Alexander Jun. 1976 80 p refs Sponsored by Office of Water Res. and Technol. Prepared in cooperation with Melbourne and Metropolitan Board of Works (Australia) and Dandenong Valley Authority (Australia)
(PB-259549/4; W77-00670; OWRT-C-5045(4224)(6)) Avail: NTIS HC A05/MF A01 CSCL 08H

Advances made in institutional arrangements and flood warning systems are reported. Functions of the Melbourne and Metropolitan Board of Works, flood problems it encounters, and its mitigative procedures, including non-structural measures, are outlined. The Dandenong Valley Authority, a unique organization having responsibilities for planning, flood protection, drainage, pollution abatement and aesthetic/recreational aspects in its 286-sq. mi. jurisdiction is discussed. GRA

N77-20975# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
CAPACITY OF A SPARTINA SALT MARSH TO ASSIMILATE NITROGEN FROM SECONDARILY TREATED SEWAGE
Alice G. Chalmers (Ga. Univ., Sepelo Island) and Evelyn B. Haines (Ga. Univ., Sepelo Island) Jul. 1976 100 p refs
(Contract DI-14-31-0001-5010)
(PB-258640/2; ERC-0776; W77-00003; OWRT-A-057-GA(1)) Avail: NTIS HC A05/MF A01 CSCL 08A

Air-fried, pulverized secondarily treated sewage sludge was applied to duplicate 100 sq m plots in a short Spartina high marsh near Sapelo Island, Georgia, at a rate of 200 g sludge, or 4 g nitrogen per square meter every two weeks for 12 months. Monthly measurements were made of nitrogen pools in the marsh plants and soils in the experimental plots and in duplicate control plots in the high marsh and in a low marsh area. Potential denitrification rates were also analyzed for marsh soils in the study sites. GRA

N77-20976# Columbia Univ., New York. Henry Krumb School of Mines.
RESEARCH NEEDS IN MINERAL PROCESSING. REPORT OF A WORKSHOP
P. Somasundaran and D. W. Fuerstenau (Calif. Univ., Berkeley) May 1976 200 p refs Conf. proc. held at New York, 1-3 Aug. 1975
(Grant NSF ENG-75-09322)
(PB-260735/6) Avail: NTIS HC A09/MF A01 CSCL 08I

Research opportunities in mineral processing, mineral requirements and research needs to meet them and environmental aspects of mineral processing are noted. Energy aspects of processing low-grade ores, grinding and liberation, classification and sizing, flotation, gravity and electrostatic and magnetic separations were covered. Hydrometallurgy, combination processes of chemical metallurgy and mineral processing, fine particles treatment, and solid-liquid separation were considered. GRA

88 SPACE SCIENCES (GENERAL)

N77-20977*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STRUCTURE AND CONTENT OF THE GALAXY AND GALACTIC GAMMA RAYS
Carl E. Fichtel, ed. and Floyd W. Stecker, ed. Washington 1977 356 p refs Symp. held at Greenbelt, Md., 2-4 Jun. 1976
(NASA-CP-002) Avail: NTIS HC A16/MF A01 CSCL 03B

Gamma radiation investigations by COS-B and SAS-2 satellite are reported. Data from CO surveys of the galaxy and the galactic distribution of pulsars are analyzed. Theories of galactic gamma ray emission are explored. For individual titles, see N77-20978 through N77-21000.

N77-20978*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GALACTIC GAMMA-RAY RESULTS. 1: DIFFUSE EMISSION **c93**
D. J. Thompson, C. E. Fichtel, R. C. Hartman, D. A. Kniffen, G. F. Bignami, R. C. Lamb, H. Oegelman (Middle East Tech. Univ.), M. E. Oezel (Middle East Tech. Univ.), and T. Tuemer (Middle East Tech. Univ.) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 3-14 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Continuing analysis of the data from the SAS-2 high energy gamma ray experiment has produced an improved picture of the sky at photon energies above 35 MeV. On a large scale, the diffuse emission from the galactic plane is the dominant feature observed by SAS-2. This galactic plane emission is most intense between galactic longitudes 310 deg and 45 deg, corresponding to a region within 7 kpc of the galactic center. Within the high-intensity region, SAS-2 observes peaks around galactic longitudes 315, 330, 345, 0, and 35 deg. These peaks appear to be correlated with galactic features and components such as molecular hydrogen, atomic hydrogen, magnetic fields, cosmic-ray concentrations, and photon fields. Author

N77-20979*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GALACTIC GAMMA-RAY RESULTS. 2: LOCALIZED SOURCES **c93**
R. C. Hartman, C. E. Fichtel, D. A. Kniffen, R. C. Lamb, D. J. Thompson, G. F. Bignami, H. Oegelman (Middle East Tech. Univ.), M. Oezel (Middle East Tech. Univ.), and T. Tuemer (Middle East Tech. Univ.) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 15-26 refs (For primary document

see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Gamma ray emission was detected from the radio pulsars PSR 1818-04 and PSR 1747-46, in addition to the previously reported gamma ray emission from the Crab and Vela pulsars. Because the Crab pulsar is the only one observed in the optical and X-ray bands, these gamma ray observations suggest a uniquely gamma ray phenomenon occurring in a fraction of the radio pulsars. PSR 1818-04 has a gamma ray luminosity comparable to that of the Crab pulsar, whereas the luminosities of PSR 1747-46 and the Vela pulsar are approximately an order of magnitude lower. SAS-2 data for pulsar correlations yielded upper limits to gamma ray luminosity for 71 other radio pulsars. For five of the closest pulsars, upper limits for gamma ray luminosity are found to be at least three orders of magnitude lower than that of the Crab pulsar. Gamma ray enhancement near the Milky Way satellite galaxy and the galactic plane in the Cygnus region is also discussed. Author

N77-20980*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE COS-B EXPERIMENT AND MISSION c93
In its The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 29-40 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The COS-B satellite carries a single experiment, capable of detecting gamma rays with energies greater than 30 MeV to study the spatial, energy, and time characteristics of high-energy radiation of galactic and extragalactic origin. The capability to search for gamma ray pulsations is enhanced by the inclusion in the payload of a proportional counter sensitive of X-rays of 2 to 12 keV. The experiment was calibrated using particle accelerators. The results of these measurements are presented, and the performance of the system in orbit is discussed. Author

N77-20981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COS-B OBSERVATIONS OF THE HIGH-ENERGY GAMMA RADIATION FROM THE GALACTIC DISK c93
In its The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 41-44 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01

The COS-B experiment has observed approximately one-fourth of the galactic disk, including the galactic-center region, the galactic anticenter, and the Vela region. A completely automatic analysis of the events recorded during these observations reveals a galactic gamma ray emission from the three regions. In the galactic center and Vela regions, the disk emission distribution was measured. From these data, the existence of a local (less than 1 kpc) and a distant (greater than 3 kpc) emitting region is apparent in the general direction of the inner galaxy. Author

N77-20982*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COS-B OBSERVATIONS OF LOCALIZED SOURCES OF GAMMA-RAY EMISSION c93
In its The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 45-52 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

In October 1975, the high-energy gamma-ray flux from the Vela pulsar measured by COS-B was found to be 1.6 to 2.1 times higher than the flux measured by SAS-2 in 1973. This factor is too large to be accounted for by error in the COS-B calibration or analysis. This is supported by a comparison of the COS-B measurement of the narrow-line component from the galactic center region with the flux derived from the measurements of SAS-2; the COS-B flux comes out about 15 percent lower than the SAS-2 figure. It is interesting to note that a glitch in the pulsar period took place about 1 month prior to the COS-B observation; the previous glitch occurred about 1.5 years before the SAS-2 observation. The increased rotational energy loss after the glitch cannot simply explain the increased gamma-ray luminosity. If the two phenomena are related, the gamma-ray emission, absorption, or beaming process must be extremely sensitive to changes in rotational parameters. The existence is confirmed of a second region of enhanced radiation in the galactic anticenter in addition to that from the Crab pulsar. Author

N77-20983*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TIME STRUCTURE OF THE GAMMA-RAY EMISSION FROM THE CRAB AND VELA PULSARS c93
In its The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 53-64 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

High resolution data on the pulsed gamma-ray emission from the Crab and Vela pulsars are presented. The light curves of these two pulsars at gamma-ray energies show striking similarities. The measured pulsed intensity from Vela at energies greater than 50 MeV was found to be .000013 sq cm/sec. The energy spectrum is not consistent with a power law. Author

N77-20984*# Naval Research Lab., Washington, D.C.
LOW- AND MEDIUM-ENERGY GALACTIC GAMMA-RAY OBSERVATIONS c93
G. H. Share *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 65-80 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Observation of 0.2 to 100 MeV-diffuse gamma-radiation emitted from a galaxy provides information on the intensities of 5 to 50 MeV/nucleon cosmic-rays and approximately less than 50-MeV electrons in interstellar space. Recent measurements of gamma-rays emitted from the galactic center region provide evidence for a diffuse continuum between 10 and 100 MeV, which is dominant over the pi-decay emission generated in high-energy nuclear collisions. The intensities of the recently reported nuclear line gamma-rays, also observed in the direction of the galactic center, require the presence of intense fluxes of low energy cosmic rays in the inner galaxy if the gamma-ray are produced on a galactic scale. Current detection techniques for 0.1 to 100 MeV gamma-ray measurements are summarized, and their capabilities for measuring the diffuse galactic emission are evaluated. Author

N77-20985*# Harvard Coll. Observatory, Cambridge, Mass.
VERY HIGH-ENERGY GAMMA RAY ASTRONOMY c93
Jonathan E. Grindlay *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 81-98 refs Prepared in cooperation with Smithsonian Astrophys. Obs. (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Recent results in ground-based very high-energy (less than 10 to the eleventh power eV) gamma-ray astronomy are reviewed. The various modes of the atmospheric Cerenkov technique are described, and the importance of cosmic ray rejection methods is stressed. The positive detections (at approximately less than 10 to the 12th power eV) of the Crab pulsar that suggest a very flat spectrum and time-variable pulse phase are discussed. Observations of other pulsars (particularly Vela) suggest that these features may be general. The steady flux upper limits for the Crab Nebula are thus reconsidered, and a new value of the implied (Compton-synchrotron) magnetic field in the Nebula is reported. Evidence that a 4.8-hour modulated effect was detected at E sub gamma is less than 10 to the 12th power eV from Cyg X-3 is strengthened in that the exact period originally proposed agrees well with a recent determination of the X-ray period. The southern sky observations are reviewed, and the significance of the detection of an active galaxy (NGC 5128) is considered for source models and future observations. Author

N77-20986*# Stanford Univ., Calif. Inst. for Plasma Research.
RADIATION MECHANISMS AND MAGNETOSPHERIC STRUCTURE OF PULSARS c90
P. A. Sturrock and K. B. Baker *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 99-108 refs (For primary document

see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03C

Considerations made in developing a model of pulsars are explored. Observational data seems to support the argument that pulsar magnetospheres may contain large masses of plasma. The cascade process resulting from pair creation enables one to interpret the X-ray emission from the Crab and Vela pulsars as synchrotron radiation. On the other hand, the optical radiation from the Crab pulsar is best understood as coherent curvature radiation. Radio emission is interpreted as curvature radiation produced by charge bunches moving along magnetic-field lines. Certain tests of this model are proposed. Author

N77-20987*# Middle East Technical Univ., Ankara (Turkey).
GAMMA RAY PULSARS **c90**
H. Oegelman, S. Ayasli, and A. Hacinliyan *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 109-118 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03C

Data from the SAS-2 high-energy gamma-ray experiment reveal the existence of four pulsars emitting photons above 35 MeV. An attempt is made to explain the gamma-ray emission from these pulsars in terms of an electron-photon cascade that develops in the magnetosphere of the pulsar. Although there is very little material above the surface of the pulsar, the very intense magnetic fields (10 to the 12th power gauss) correspond to many radiation lengths which cause electrons to emit photons by magnetic bremsstrahlung and which cause these photons to pair-produce. The cascade develops until the mean photon energy drops below the pair-production threshold which is in the gamma-ray range; at this stage, the photons break out from the source. Author

N77-20988*# Virginia Univ., Charlottesville. Dept. of Applied Mathematics and Computer Science.
DENSITY WAVE THEORY **c90**
W. W. Roberts, Jr. *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 119-150 refs (For primary document see N77-20977 11-88)
(Grant NSF AST-72-05124-A03)
Avail: NTIS HC A16/MF A01 CSCL 03B

The prospect that density waves and galactic shock waves are present on the large scale in disk shaped galaxies has received support in recent years from both theoretical and observational studies. Large-scale galactic shock waves in the interstellar gas are suggested to play an important governing role in star formation, molecule formation, and the degree of development of spiral structure. Through the dynamics of the interstellar gas and the galactic shock-wave phenomenon, a new insight into the physical basis underlying the morphological classification system of galaxies is suggested. Author

N77-20989*# Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
THE GALACTIC DISTRIBUTION (IN RADIUS AND Z) OF INTERSTELLAR MOLECULAR HYDROGEN **c90**
N. Z. Scoville, P. M. Solomon (State Univ. of N. Y., Stony Brook), and D. B. Sanders (State Univ. of N. Y., Stony Brook) *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 151-162 refs (For primary document see N77-20977 11-88)
(Grant NSF MPS-73-D4949)
(Contrib-232) Avail: NTIS HC A16/MF A01 CSCL 03B

Observations of the galactic longitude and latitude distributions of lambda = 2.6 mm CO emission are presented. Analysis of these spectral-line data yields the large-scale distribution of molecular clouds in the galactic disk and their z-distribution out of the disk. Strong maxima in the number of molecular clouds occur in the galactic nucleus and at galactic radii 4 to 8 kpc. The peak at 4 to 8 kpc correlates well with a region of enhanced 100-MeV gamma-ray emissivity. This correlation strongly supports the conclusion that the gamma-rays are produced as a result of cosmic ray interactions in molecular H2 clouds rather than in H(I). The width of the cloud layer perpendicular to the galactic plane between half-density points is 105 plus or minus 15 pc near the 5.5-kpc peak. The total mass of molecular gas in the interior of the galaxy exceeds that of atomic hydrogen and is 30 to the 9th power solar mass based on these observations. Author

N77-20990*# National Radio Astronomy Observatory, Green Bank, W. Va.
REMARKS ON THE OVERALL DISTRIBUTION OF HYDROGEN IN THE GALACTIC DISK **c90**
W. B. Burton *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 163-188 refs Sponsored in part by NSF (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The degree of saturation characterizing low altitude emission observations of H(I) and the optical depth corrections to the derived column and volume densities are discussed. The amount of fine-scale velocity and spatial structure diluted by the instrumental limitations of the presently available surveys are described. The general problem of detailed mapping of H(I) in the galaxy is explored. Comparison is made between the distribution of H(I) and that of CO and several other galactic tracers. Atomic hydrogen is unique in its distribution, instead of being typical of many Population I constituents. As defined by atomic hydrogen, the galactic disk has a diameter fully twice as large as that defined by the ionized and molecular states of hydrogen, as well as by other molecules, supernova remnants, pulsars, gamma-radiation, synchroton radiation, and the youngest stars. It is also less confined to the galactic equator than most of the other constituents. The degree of small scale structure apparent in the molecular observations is much greater than that in the H(I) observations. Author

N77-20991*# Cambridge Univ. (England). Cavendish Lab.
THE NONTHERMAL RADIATION IN THE GALAXY **c93**
J. E. Baldwin *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 189-202 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Observations of the distribution of brightness at intermediate latitudes in the galaxy and of the edge-on spiral galaxy, NGC 891, indicate that the emissivity extends to heights of several kpc perpendicular to the plane. In several galaxies, the angular distributions of neutral hydrogen and nonthermal emission are roughly coextensive and show similar features such as spiral structure. If radio galaxies and normal galaxies with strong nuclear radio sources are excluded, there appears to be a proportionality between their total H(I) content and their nonthermal radio luminosity. Author

N77-20992*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFRARED ASTRONOMY AND HIGH ENERGY ASTROPHYSICS **c89**
Giovanni G. Fazio (Center for Astrophysics) and F. W. Stecker *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 203-214 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03A

Observations of the diffuse far-infrared flux from the galactic plane, as well as far-infrared measurements of the properties of dense molecular clouds, when combined with recent high-energy gamma-ray measurements and radio observations of carbon monoxide, yield information about the total mass of molecular clouds, the large-scale structure of the inner galaxy, and the density of cosmic rays. Author

N77-20993*# Princeton Univ. Observatory, N.J.
ULTRAVIOLET OBSERVATIONS OF LOCAL GAS **c90**
E. B. Jenkins *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 215-228 refs (For primary document see N77-20977 11-88)
(Contract NAS5-1810)
Avail: NTIS HC A16/MF A01 CSCL 03B

From satellite measurements of ultraviolet spectra of stars, an average density of approximately 1.1 cu m/sec for hydrogen atoms, in both atomic and molecular form, is estimated for regions

of space along the galactic plane within about 1 kpc of the sun. About 20 percent of the atoms are bound in molecular form, although this figure is uncertain because the ultraviolet measurements avoid the very dense interstellar clouds. Discrete values for this percentage are observed to vary markedly; regions with less than average density appear to have fractional abundances of H2 several orders of magnitude lower than average. A ratio of CO/H which ranges from 10 to the minus 9th to 10 to the minus 6th power is observed for regions in front of stars observed by the Copernicus satellite. Author

N77-20994*# Observatoire de Paris-Meudon (France).
SMALL SCALE LOCAL GAMMA RAY FEATURES c93
J. L. Puget, C. Ryter (Centre d'Etude Nucl. de Saclay), and G. Serra (Centre d'Etude Spatiale des Rayonnements) *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 229-236 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

In order to draw implications from nearby gamma-ray emission, the different ways that can be used to obtain an estimate of the amount of matter on each line of sight are investigated. It is shown that, within present uncertainties, the cosmic ray intensity inside molecular clouds within 1 kpc from the sun is the same as the cosmic ray intensity measured at the sun. In the last part, what can be learned from a comparison of far infrared and gamma-ray data is discussed. Author

N77-20995*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIFFUSE GALACTIC GAMMA RAY LINES c93
R. E. Lingenfelter (Calif. Univ., Los Angeles) and R. Ramaty *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 237-256 refs (For primary document see N77-20977 11-88)
(Grant NSF AST-67-08178)
Avail: NTIS HC A16/MF A01 CSCL 03B

The production rate of 4.44-MeV line for a variety of assumed cosmic ray spectra is evaluated. These results are compared with reported galactic gamma-ray line intensities and are consistent with a low energy cosmic ray density which increases toward the galactic center in proportion to the molecular gas density. Author

N77-20996*# Illinois Univ., Urbana. Dept. of Astronomy.
GAMMA RAYS AND SUPERNOVA EXPLOSIONS c90
W. D. Arnett *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 257-264 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Thermal radiation associated with the explosion of supernovae is investigated. High temperature is required to produce copious gamma radiation of this sort. It appears that type 11 supernovae do not release much of their energy as gamma ray continuum radiation. Author

N77-20997*# Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
GALACTIC DISTRIBUTION OF PULSARS c90
J. H. Seiradakis *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 265-282 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The density distributions of pulsars in luminosity, period, Z-distance, and galactocentric distance were derived, using a uniform sample of pulsars detected during a 408-MHz pulsar survey at Jodrell Bank. There are indications of a fine-scale structure in the spatial distributions and evidence that there is a general correlation with other galactic populations and the overall spiral structure. The electron layer in our galaxy is shown to be wider than the pulsar layer and uniform on a large scale. The number of pulsars in the galaxy has been estimated and used to derive the pulsar birthrate. Author

N77-20998*# Laboratory for Astrophysics and Space Research, Chicago, Ill.
COSMIC-RAY PROPAGATION AND CONTAINMENT c93
E. N. Parker *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 283-299 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

The cosmic rays are an active gaseous component of the disk of the galaxy, and their propagation and containment is a part of the general dynamics of the disk. The sources of cosmic rays are a matter of speculation. The disk is inflated by the cosmic-ray gas pressure, P, comparable to the magnetic pressure B super 2/ 8 pi, but the rate of inflation is unknown. The time spent by the individual cosmic-ray particles in the disk is inversely proportional to the cosmic-ray production rate and may be anything from 100,000 to more than 10 million years. It is evident from the decay of Be(10) that the cosmic rays circulate through a volume of space perhaps ten times the thickness of the gaseous disk, suggesting a magnetic halo extending out approximately 1 kpc from either face of the disk. The cosmic rays may be responsible for the halo by inflating the magnetic fields of the disk. Extension of the fields to 1 kpc would imply a high production rate and short life of cosmic rays in the dense gaseous disk of the galaxy. Author

N77-20999*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS AND LARGE SCALE GALACTIC STRUCTURE c90
D. A. Kniffen, C. E. Fichtel, and D. J. Thompson *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 301-314 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Gamma ray astronomy is now beginning to provide a new look at the galactic structure and the distribution of cosmic rays, both electrons and nucleons, within the galaxy. The observations are consistent with a galactic spiral-arm model in which the cosmic rays are linearly coupled to the interstellar gas on the scale of the spiral arms. The agreement between the predictions of the model and the observations for regions of the plane where both 21-cm and 2.6-mm CO surveys exist emphasizes the need to extend these observations to include the entire plane. Future gamma-ray observations with more sensitivity and better angular resolutions, combined with these radio surveys, should shed new light on the distribution of cosmic rays, the nature of the galaxy, and the location and intensity of the spiral arms. Author

N77-21000*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS, COSMIC RAYS, AND GALACTIC STRUCTURE c90
F. W. Stecker *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 315-346 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

Observations of cosmic and gamma radiation by SAS-2 satellite are summarized and analyzed to determine processes responsible for producing observed galactic radiation. In addition to the production of gamma rays in discrete galactic objects such as pulsars, there are three main mechanisms by which high-energy (greater than 100 MeV) radiation is produced by high-energy interactions involving cosmic rays in interstellar space. These processes, which produce what may be called diffuse galactic gamma-rays, are: (1) the decay of pi mesons produced by interactions of cosmic ray nucleons with interstellar gas nuclei; (2) the bremsstrahlung radiation produced by cosmic ray electrons interacting in the Coulomb fields of nuclei of interstellar gas atoms; and (3) Compton interactions between cosmic ray electrons and low-energy photons in interstellar space. Author

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-21001*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
A PRACTICAL HADAMARD TRANSFORM SPECTROMETER FOR ASTRONOMICAL APPLICATION
Ming-Hing Tai Jan. 1977 221 p refs
(Grant NGR-33-010-210)
(NASA-CR-149790; CRSR-655) Avail: NTIS HC A10/MF A01 CSCL 03A

The mathematical properties of Hadamard matrices and their application to spectroscopy are discussed. A comparison is made between Fourier and Hadamard transform encoding in spectrometry. The spectrometer is described and its laboratory performance evaluated. The algorithm and programming of inverse transform are given. A minicomputer is used to recover the spectrum. Author

N77-21002# Royal Greenwich Observatory, Herstmonceux (England).
ROYAL GREENWICH OBSERVATORY REPORT FOR THE PERIOD 1ST JANUARY TO 30TH SEPTEMBER 1975
D. V. Thomas, ed. and Joan E. Perry, ed. 1976 66 p refs
Avail: NTIS HC A04/MF A01; Roy. Greenwich Obs., Herstmonceux, Engl. £1

The activities of the observatory are reported. Items discussed are national facilities, astronomical research, national and international services, and internal services. ESA

N77-21003# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
CONCEPTUAL AND FEASIBILITY STUDY OF THE SPACE TELESCOPE SOLAR ARRAY (STESA) Final Technical Report
H. Brodersen, H. Schweig, I. Rizos, W. Schultze, E. Sach, J. Ellinger, R. Reiter, W. Nagl, and H. Imbiel Oct. 1976 89 p
(Contract ESTEC-2642/76/NL/PP(SC))
(MBB-URV-96; ESA-CR(P)-883) Avail: NTIS HC A05/MF A01

A conceptual study is presented of a solar array for the large space telescope. An improved carbon fiber sandwich structure is proposed as structural material. A baseline structural design is described and several aspects concerning flight performance are discussed. They include thermal behavior, electrical design, dynamic and stress analysis, mechanisms, and reliability and safety. A development program is proposed. ESA

N77-20992*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFRARED ASTRONOMY AND HIGH ENERGY ASTROPHYSICS
Giovanni G. Fazio (Center for Astrophysics) and F. W. Stecker *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 203-214 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N77-21004*# Kanner (Leo) Associates, Redwood City, Calif.
THE STATISTICAL STUDY OF DARK NEBULAE
D. Sh. Khavtasi Washington NASA Mar. 1977 109 p refs Transl. into ENGLISH from Byul. Abastumanskoy Astrofiz. Observ. (USSR), no. 18, 1955 p 29-115
(Contract NASw-2790)
(NASA-TT-F-17416) Avail: NTIS HC A06/MF A01 CSCL 03B

A catalog of dark nebulae is presented, based on previous atlases of regions of the heavens. Statistical functions involved with dark nebulae are evolved. The latter include the functions of distribution of dark nebulae according to galactic coordinates, apparent and true areas, weight, and mass. Some structural aspects of dark nebulae are also discussed. These nebulae are grouped, and some possible relationships between them and nearby celestial objects are shown. Author

N77-21005# Texas Univ., Austin. Center for Particle Theory.
STELLAR ENERGY LOSS RATES DUE TO SPT NEUTRAL CURRENTS
Duane A. Dicus and E. W. Kolb May 1976 14 p refs
(Contract E(40-1)-3992)
(ORO-3992-262) Avail: NTIS HC A02/MF A01

The energy loss rate in stellar matter due to neutrino production was calculated assuming the weak leptonic neutral current includes scalar, pseudoscalar, or tensor covariants. Different processes were considered in the respective temperature and density regions of physical significance. Comparison with observed stellar lifetimes allow an upper limit to be placed on the new couplings. Author (ERA)

N77-21006*# National Bureau of Standards, Boulder, Colo.
EARTH ROTATION MEASURED BY LUNAR LASER RANGING Final Report
A. Stolz, P. L. Bender, J. E. Faller, E. C. Silverberg, J. D. Mulholland, P. J. Shelus, J. G. Williams, W. E. Carter, D. G. Currie, and W. M. Kaula 1976 6 p refs Submitted for publication Sponsored in part by NASA, Joint Inst. for Lab. Astrophysics, Boulder, Colo. and McDonald Obs., Austin, Tex.
(NASA-CR-148749; PB-259713/6) Avail: NTIS HC A02/MF A01 CSCL 03C

The estimated median accuracy of 194 single-day determinations of the earth's angular position in space is 0.7 millisecond (0.01 arc second). Comparison with classical astronomical results gives agreement to about the expected 2-millisecond uncertainty of the 5-day averages obtained by the Bureau International de l'Heure. Little evidence for very rapid variations in the earth's rotation is present in the data. GRA

N77-20986*# Stanford Univ., Calif. Inst. for Plasma Research.
RADIATION MECHANISMS AND MAGNETOSPHERIC STRUCTURE OF PULSARS
P. A. Sturrock and K. B. Baker *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 99-108 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03C

N77-20987*# Middle East Technical Univ., Ankara (Turkey).
GAMMA RAY PULSARS
H. Oegelman, S. Ayasli, and A. Hacinliyan *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 109-118 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03C

N77-20988*# Virginia Univ., Charlottesville. Dept. of Applied Mathematics and Computer Science.
DENSITY WAVE THEORY
W. W. Roberts, Jr. *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 119-150 refs (For primary document see N77-20977 11-88)
(Grant NSF AST-72-05124-A03)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20989*# Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
THE GALACTIC DISTRIBUTION (IN RADIUS AND Z) OF INTERSTELLAR MOLECULAR HYDROGEN
N. Z. Scoville, P. M. Solomon (State Univ. of N. Y., Stony Brook), and D. B. Sanders (State Univ. of N. Y., Stony Brook) *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 151-162 refs (For primary document see N77-20977 11-88)
(Grant NSF MPS-73-D4949)
(Contrib-232) Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20990*# National Radio Astronomy Observatory, Green Bank, W. Va.
REMARKS ON THE OVERALL DISTRIBUTION OF HY-

DROGEN IN THE GALACTIC DISK
W. B. Burton *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 163-188 refs Sponsored in part by NSF (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20993*# Princeton Univ. Observatory, N.J.
ULTRAVIOLET OBSERVATIONS OF LOCAL GAS
E. B. Jenkins *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 215-228 refs (For primary document see N77-20977 11-88)
(Contract NAS5-1810)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20996*# Illinois Univ., Urbana. Dept. of Astronomy.
GAMMA RAYS AND SUPERNOVA EXPLOSIONS
W. D. Arnett *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 257-264 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20997*# Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
GALACTIC DISTRIBUTION OF PULSARS
J. H. Seiradakis *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 265-282 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20999*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS AND LARGE SCALE GALACTIC STRUCTURE
D. A. Kniffen, C. E. Fichtel, and D. J. Thompson *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 301-314 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-21000*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS, COSMIC RAYS, AND GALACTIC STRUCTURE
F. W. Stecker *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 315-346 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-21007*# Georgia Inst. of Tech., Atlanta. Solid State Sciences Div.
CARBON DISTRIBUTION PROFILES IN LUNAR FINES Final Report, 1 Feb. 1976 - 31 Jan. 1977
Raymond K. Hart 31 Jan. 1977 31 p refs
(Grant NsG-9040)
(NASA-CR-152622) Avail: NTIS HC A03/MF A01 CSCL 03B

Radial distribution profiles of elemental carbon in lunar soils consisting of particles in the size range of 50 to 150 microns were investigated. Initial experiments on specimen preparation and the analysis of prepared specimens by Auger electron spectrometry (AES) and scanning electron microscopy (SEM) are described. Results from splits of samples 61501,84 and 64421,11, which were mounted various ways in several specimen holders, are presented. A low carbon content was observed in AES spectra from soil particles that were subjected to sputter-ion cleaning with 960eV argon ions for periods of time up to a total exposure for one hour. This ion charge was sufficient to remove approximately 70 nm of material from the surface. All of the physically adsorbed carbon (as well as water vapor, etc.) would normally be removed in the first few minutes, leaving only carbon in the specimen, and metal support structure, to be detected thereafter. Author

N77-21008# Texas Univ., Galveston.
ORIGIN OF MAGNETIZATION IN LUNAR BRECCIAS: AN EXAMPLE OF THERMAL OVERPRINTING
W. A. Gose, D. W. Strangway (Toronto Univ., Canada), and G. W. Pearce (Toronto Univ., Canada) [1976] 26 p refs
(Grant NsG-9021)
(NASA-CR-149912; Contrib-85) Avail: NTIS HC A03/MF A01 CSCL 03B

Twenty six samples collected from the station 6 boulder at the Apollo 17 landing site were studied magnetically. The boulder is a breccia consisting of three lithologic units distinguished by their clast population. It is proposed that the natural remanent magnetization (NRM) in lunar breccias is the vector sum of two magnetizations, a pre-impact magnetization and a partial thermoremanence acquired during breccia formation. The relative contribution of the two components is controlled by the thermal history of the ejecta blanket, which in turn is determined by its clast population. This model of thermal overprinting is consistent with petrographic and isotope analyses. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-21009# Los Alamos Scientific Lab., N.Mex.
SOLAR-COSMIC-RAY VARIABILITY
Robert C. Reedy 1976 4 p refs Presented at 7th Lunar Sci. Conf. on Utilization of Lunar Materials and Expertise for Large Scale Operations in Space, Houston, Tex., 15 Mar. 1976
(Contract W-7405-eng-36)
(LA-UR-76-494; Conf-760323-1) Avail: NTIS HC A02/MF A01

The maximum flux of particles from solar events that should be considered in designing the shielding for a space habitation is discussed. The activities of various radionuclides measured in the top few centimeters of lunar rocks are used to examine the variability of solar cosmic ray fluxes over the last five million years. Author (ERA)

N77-21010# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 385. PART 1: (PROMPT REPORTS). DATA FOR AUGUST - JULY 1976. EXPLANATION OF DATA REPORTS ISSUED AS NO. 378 (SUPPLEMENT) FEBRUARY 1976
Hope I. Leighton, ed. Sep. 1976 118 p
(PB-261461/8; SGD-385-Pt-1; NOAA-76101201-Pt-1) Avail: NTIS MF A01; HC available from National Climatic Center, Attn: Publications. Federal Bldg., Asheville, N. C. 28801. Subscription $34.00/year includes Part 1 (Prompt Reports) and Part 2 (Comprehensive Reports); $18.00/year for either part. Annual supplement containing explanation is included. $1.50/copy for either part; $1.40 for the extra issue CSCL 03B

This prompt report provides August 1976 and July 1976 data on: alert periods, daily solar indexes, solar flares; solar radio waves, solar X-ray radiation, coronal holes, and inferred IP magnetic field polarities, daily solar activity center, sudden ionospheric disturbances, cosmic rays, geomagnetic indexes and radio propagation indexes. GRA

N77-21011# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR GEOPHYSICAL DATA NUMBER 385. PART 2: (COMPREHENSIVE REPORTS). DATA FOR MARCH -

FEBRUARY 1976 AND MISCELLANEA. EXPLANATION OF DATA REPORTS ISSUED AS NO. 378 (SUPPLEMENT) FEBRUARY 1976
Hope I. Leighton, ed. Sep. 1976 66 p refs
(PB-261462/6; SGD-385-Pt-2; NOAA-76101202-Pt-2) Avail: NTIS MF A01; HC available from National Climate Center, Attn: Publications. Federal Bldg., Asheville, N. C. 28801. Subscription $34.00/year includes Part 1 (Prompt Reports) and Part 2 (Comprehensive Reports); $18.00/year for either part. Annual supplement containing explanation is included. $1.50/copy for either part; $1.40 for the extra issue CSCL 03B

This comprehensive report for March 1976, and February 1976 and Miscellanea provides data on: solar flares, solar radio waves, energetic solar particles and plasma, abbreviated calendar record, regional flare index, spectral and radioheliograph events - Culgoora June 1976, and geomagnetic indexes - June 1976. GRA

N77-21012# National Center for Atmospheric Research, Boulder, Colo.
NONRELATIVISTIC ELECTRON STREAM PROPAGATION IN THE SOLAR ATMOSPHERE AND SOLAR WIND: TYPE III BURSTS Ph.D. Thesis - Colorado Univ., Boulder
Glenn R. Magelssen 1976 200 p refs
(Contract NSF C-760)
(PB-258553/7; NCAR-CT-37) Avail: NTIS HC A09/MF A01 CSCL 03B

Electron streams with type III burst characteristics were numerically modeled. The electron stream distribution was assumed to be one-dimensional in spatial and velocity space, and the corresponding excited plasma wave spectrum was assumed to be one-dimensional in spatial and phase velocity space. Quasilinear equations with the addition of spontaneous emission, magnetic and collisional effects were solved as an initial value problem with time, space, and velocity as the independent variables for a solar-type background plasma and a type-III-like stream. Background density and temperature spatial structure, spontaneous emission, magnetic fields, electron-ion collisions, stream wave reabsorption and wave pileup are shown to affect stream propagation and are incorporated into a physical description of this propagation. GRA

N77-21013# Naval Electronics Lab. Center, San Diego, Calif.
SOLAR ACTIVE-REGION CHARACTERISTICS AT RADIO WAVELENGTHS AND THEIR RELATION TO PROTON EVENTS Research and Development Report, Jul. 1975 - Jun. 1976
Max P. Bleiweiss, Fred L. Wefer, and Marshall D. Hurst 30 Jul. 1976 26 p refs
(AD-A031319; NELC-TR-1999) Avail: NTIS HC A03/MF A01 CSCL 03/2

The literature dealing with solar events and their effects upon electromagnetic propagation was surveyed and the data were compared with those taken by the La Posta Astrogeophysical Observatory of the Naval Electronics Laboratory Center. These latter data do not contain obvious 'radio signatures' for identifying proton-producing active regions. Additional efforts are required. Author (GRA)

N77-21014# Air Force Geophysics Lab., Hanscom AFB, Mass.
MAGNETIC FIELDS IN THE SOLAR ATMOSPHERE Environmental Research Papers
Jacques Maurice Beckers 22 Jun. 1976 35 p refs
(AF Proj. 7649)
(AD-A031300; AFGL-TR-76-0131; AFGL-ERP-568) Avail: NTIS HC A03/MF A01 CSCL 03/2

This paper describes the magnetic field configurations observed in the solar atmosphere including the corona and the solar wind. The techniques for observing solar magnetic fields are briefly reviewed. The significance of Alfven waves in transporting energy is stressed. Author (GRA)

N77-21015# Air Force Geophysics Lab., Hanscom AFB, Mass.
A HIGH RESOLUTION SPECTRAL ATLAS OF THE SOLAR IRRADIANCE FROM 380 TO 700 NANOMETERS. VOLUME 2: GRAPHICAL FORM
Jacques Maurice Beckers, Charles A. Bridges, and Lou B. Gilliam 16 Jun. 1976 166 p
(AF Proj. 7649)
(AD-A031301; AFGL-TR-76-0126(2); AFGL-ERP-565-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 03/2

This report presents in graphical form the spectrum of the solar irradiance with high spectral resolution. Author (GRA)

N77-21016# Tufts Univ., Medford, Mass. Dept. of Physics.
FINE SCALE RADIO STUDIES OF THE SUN Final Technical Report, 1 Jun. 1975 - 30 Jun. 1976
Kenneth R. Lang 15 Jul. 1916 17 p refs
(Contract F19628-76-C-0020; AF Proj. 4643)
(AD-A031305; AFGL-TR-76-0167) Avail: NTIS HC A02/MF A01 CSCL 03/2

Major flare eruptions in solar active regions create geophysical disturbances that may seriously disrupt Air Force communication and surveillance systems. Preliminary interferometric observations of the Sun by the principal investigator revealed significant changes in the fine scale structure of the region hours in advance of a flare eruption. The present contractual effort sought to confirm this vital observation and to obtain more information on the small-sized flare trigger sources that could be applied in a reliable flare forecast technique. GRA

N77-21017# Harvard Coll. Observatory, Cambridge, Mass.
INVESTIGATIONS OF SOLAR FLARES, QUIET AND ACTIVE REGIONS BASED ON EUV AND RADIO OBSERVATIONS Final Report, 1 Jul. 1973 - 30 Jun. 1976
George L. Withbroe and Jorge E. Vernazza 30 Sep. 1976 5 p refs
(Contract F19628-74-C-0018)
(AD-A031500; AFGL-TR-76-0217) Avail: NTIS HC A04/MF A01 CSCL 03/2

This report summarizes several investigations of the quiet and active solar atmosphere. It includes a discussion of a technique for studying the physical conditions in active region loops and the application of the technique to loops in McMath region 12628 and loops associated with the 7 September 1973 proton flare in McMath region 12507. The report also summarizes some work on coronal hole models, models for the chromosphere and an investigation of relationships between flare rates and 8.6 mm brightness temperatures. Author (GRA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-21018*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF THE THEORY OF HIGH ENERGY ION TRANSPORT
John W. Wilson Washington Mar. 1977 29 p refs
(NASA-TN-D-8381; L-11150) Avail: NTIS HC A03/MF A01 CSCL 03B

Procedures for the approximation of the transport of high-energy ions are discussed on the basis of available data on ion nuclear reactions. A straightahead approximation appears appropriate for space applications. The assumption that the secondary-ion-fragment velocity is equal to that of the fragmenting nucleus is inferior to straightahead theory but is of sufficient accuracy if the primary ions display a broad energy spectrum. An iterative scheme for the solution of the inhomogenous integral transport equations holds promise for practical calculation. A model calculation shows that multiple charged ion fragments penetrate to greater depths in comparison with the free path of a primary heavy ion. Author

N77-21019# Manila Observatory (Philippines).
POSSIBLE FERMI MECHANISM OF SOLAR COSMIC RAYS
Victor L. Badillo 16 Aug. 1976 11 p refs
(Contract F19628-76-C-0026)
(AD-A032312; AFGL-TR-76-0193; SR-1) Avail: NTIS

HC A02/MF A01 CSCL 03/2

Pulsations in solar radio bursts suggest Fermi acceleration of particles trapped in solar magnetic loop. Simple model indicates acceleration of thermal protons to subrelativistic energies within a few seconds. Author (GRA)

N77-20978*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GALACTIC GAMMA-RAY RESULTS. 1: DIFFUSE EMISSION
D. J. Thompson, C. E. Fichtel, R. C. Hartman, D. A. Kniffen, G. F. Bignami, R. C. Lamb, H. Oegelman (Middle East Tech. Univ.), M. E. Oezel (Middle East Tech. Univ.), and T. Tuemer (Middle East Tech. Univ.) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 3-14 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20979*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GALACTIC GAMMA-RAY RESULTS. 2: LOCALIZED SOURCES
R. C. Hartman, C. E. Fichtel, D. A. Kniffen, R. C. Lamb, D. J. Thompson, G. F. Bignami, H. Oegelman (Middle East Tech. Univ.), M. Oezel (Middle East Tech. Univ.), and T. Tuemer (Middle East Tech. Univ.) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 15-26 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20980*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE COS-B EXPERIMENT AND MISSION
In its The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 29-40 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COS-B OBSERVATIONS OF THE HIGH-ENERGY GAMMA RADIATION FROM THE GALACTIC DISK
In its The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 41-44 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01

N77-20982*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COS-B OBSERVATIONS OF LOCALIZED SOURCES OF GAMMA-RAY EMISSION
In its The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 45-52 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20983*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TIME STRUCTURE OF THE GAMMA-RAY EMISSION FROM THE CRAB AND VELA PULSARS
In its The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 53-64 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20984*# Naval Research Lab., Washington, D.C.
LOW- AND MEDIUM-ENERGY GALACTIC GAMMA-RAY OBSERVATIONS
G. H. Share *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 65-80 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20985*# Harvard Coll. Observatory, Cambridge, Mass.
VERY HIGH-ENERGY GAMMA RAY ASTRONOMY
Jonathan E. Grindlay *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 81-98 refs Prepared in cooperation with Smithsonian Astrophys. Obs. (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20991*# Cambridge Univ. (England). Cavendish Lab.
THE NONTHERMAL RADIATION IN THE GALAXY
J. E. Baldwin *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 189-202 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20994*# Observatoire de Paris-Meudon (France).
SMALL SCALE LOCAL GAMMA RAY FEATURES
J. L. Puget, C. Ryter (Centre d'Etude Nucl. de Saclay), and G. Serra (Centre d'Etude Spatiale des Rayonnements) *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 229-236 refs (For primary document see N77-20977 11-88)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20995*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIFFUSE GALACTIC GAMMA RAY LINES
R. E. Lingenfelter (Calif. Univ., Los Angeles) and R. Ramaty *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 237-256 refs (For primary document see N77-20977 11-88)
(Grant NSF AST-67-08178)
Avail: NTIS HC A16/MF A01 CSCL 03B

N77-20998*# Laboratory for Astrophysics and Space Research, Chicago, Ill.
COSMIC-RAY PROPAGATION AND CONTAINMENT
E. N. Parker *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays 1977 p 283-299 refs (For primary document see N77-20977 11-88)
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99 GENERAL

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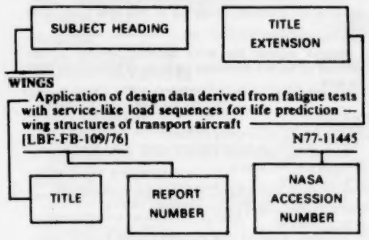

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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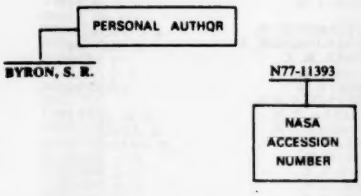
Zirconium modified nickel-copper alloy
[NASA-CASE-LEW-12245-1] N77-20201

PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing



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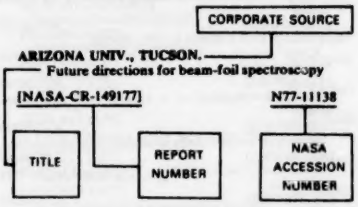

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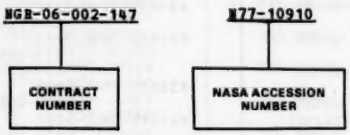

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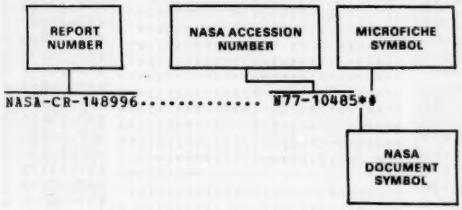

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NASA-TM-X-73639 ..... N77-20482*#
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